

**The perceived value and use of public open space in high- and
low-density communities**

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Master of Philosophy

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Statement of Original Authorship

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Abstract

The way in which residents value and use public open space is relevant to many urban and recreation planners. As rapid population growth occurs in urban areas, public infrastructure often becomes strained. It is fundamental that urban and recreation planners understand the wants and needs of a community in order to provide well-planned public open spaces. The aim of this study was to understand the differences between how residents in high- and low-density areas value and use public open space. This knowledge can be used by urban planners to design public open space to provide a space which positively impacts the health of future communities. This cross-sectional study explored the perceived value and use of public open space in high- and low-density communities in a select area within the Blacktown local government, New South Wales (NSW), Australia. Population growth in this area has been rapid and ongoing. High-density housing developments are proposed as a solution to this demand. A questionnaire was developed for the study and then distributed to a purposive sample of 1089 high- and low-density residents, resulting in 159 responses. Residents' responses to the questionnaire covered the topics of public open space usage and value, as well as self-reported health data. Responses were analysed using descriptive statistical methods and comparative techniques. Results indicated that all respondents valued their local public open space, however public open space was used differently by residents depending on their level of housing density. The results of this research may be utilised by local governments, policy makers and planning agencies who are working in communities where rapid population growth is occurring, to guide the provision of public open space specific to the needs of their communities. Future research could involve the replication of this study within other local government areas to expand the body of knowledge surrounding the differences in public open space value and usage between high- and low-density communities.

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Origins of the Study

Whilst working as a recreation planner at Blacktown City Council, I was faced with a rapidly growing population and the role of determining the public open space provision requirements for my community. Whilst researching all of the elements that go along with this provision, such as size, location, accessibility and infrastructure choices, it came to my attention that there were no widely accepted benchmarks or provision guidelines for these elements. Further to this, I did not understand how the existing network of public open space in my community was being used, or if it was even of value to the community. I saw this as an opportunity to explore what my community wanted and, more importantly, what residents needed to ensure that they had the desire to utilise their nearby public open space to lead active and healthy lifestyles. At this time, there was a rapid increase in high-density living arrangements within my local government area, and as a recreation planner, I had no theoretical basis which justified the provision levels of public open space. The research questions answered in this study were derived from wanting to know more about how people in high- and low-density communities value and use their public open space. My passion for healthy living lead to the completion of a Graduate Certificate of Lifestyle Medicine before transferring into a Master of Philosophy to further explore the topic of public open space value and usage.

Whilst I began my research as an employee of Blacktown City Council, I relocated to regional NSW early in my study. This put a new focus on my study as I began to see the role of recreation planning very differently. At a regional level, I can now see exactly how public open space can impact the lives of individuals in the community. This drives me even further to understand what the differences are between high- and low-density areas. I am extremely passionate about the role that public open space can play in promoting the health of a community, and hope to see more research explore this in the future.

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Abbreviations

BMI	Body Mass Index
CPTED	Crime Prevention through Environmental Design
LEP	Local Environmental Plan
LGA	Local Government Area
NHMRC	National Health and Medical Research Council
NSW	New South Wales
POS	Public Open Space
SEIFA	Socio-economic Indexes for Areas
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organisation

Glossary of Key Terms

Density	Dwelling density per hectare of land
High-density	65+ dwellings per hectare
Low-density	1-29 dwellings per hectare
Medium Density	30-65 dwellings per hectare
Public Open Space	Council land available primarily for recreation or sporting activities. This includes council owned land, council managed land, and state government land.
R2 Low-density Residential	Housing provided for the community in a way that does not affect the amenity of the neighbourhood
R4 High-density Residential	Housing provided for the community in a high-density environment in flats close to public transport hubs and centres

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Chapter 1: Introduction

1.1 Background to the topic

The relationship between Public Open Space (POS) and an individual's health have been widely explored, however, research determining what the value of POS is to the community is limited, and whether or not this value differs between high- and low-density communities. Australia is currently experiencing a rapid increase in population which is placing large demands on public infrastructure (NSW Government Department of Planning and Environment, 2014). High-density living and urban consolidation are proposed as a solution to this urban growth, however, it is the responsibility of local government recreation, urban and open space planners to ensure that this does not compromise POS provision (Parks and Leisure Australia, 2013).

As POS is often used as a place for exercise and social interaction with others, decreasing provision or access for residents can be detrimental to an individual's wellbeing. Decreased POS provision has the ability to negatively impact physical and mental health (Lowe, Boulange, & Giles-Corti, 2014), community cohesion and child development (Byrne & Sipe, 2010). High-density living minimises outdoor opportunities due to the low or non-existent provision of private open space in the form of backyard areas. It is essential that POS is provided for residents living in high-density areas; however, it is not known to what extent provision should differ between high- and low-density residential areas.

To have a better and more complete understanding of this topic, it is important to understand how density is defined; how the population affects housing density; the health impacts of density and POS; and the advantages and disadvantages of high-density living. These concepts are explored through a critique of the literature.

1.2 Thesis overview

This thesis is presented in seven chapters. The first chapter provides an introduction to the topic of research and the context surrounding the development of the research. This chapter also presents the study aim and research questions to be answered. The second chapter provides a critical analysis of the literature that addresses high- and low-density communities; population and housing density; public open space benefits; public open space planning and provision; and the advantages and disadvantages of high-density living. Chapter three provides a detailed explanation of the methodology and research design used. Chapter four presents the results and key findings of the study. Chapter five presents a discussion of the key findings of the study, with links to current and past literature. Chapter six concludes the thesis and presents a series of recommendations developed from the research.

1.3 Significance of study

Findings from this research presented in this thesis, have the potential to inform the activities of local governments across Australia, including regulatory and planning bodies who are involved in planning POS within their geographical areas of control, and inform discussion of whether planning provision guidelines and distribution of POS need to change depending upon density of the surrounding neighbourhood. My study provides a basis on which other research can be built to create a substantiated body of literature. Having a body of literature to draw upon, will assist future open space planning decisions. An understanding of how residents in high- and low-density living value and use POS will be reached, so as to inform local government and planners for future development. The study will also provide insight into what is of value to residents when considering POS. Self-reported health data was captured, which allowed relationships to be identified between health status and POS usage. This study provides an insight into the possible differences between high- and low-density communities and how these differences should be accommodated.

1.4 Study aims

The aim of my research was to determine whether or not high- and low-density communities value and use POS differently, and therefore desire different qualities in POS in Blacktown, NSW, Australia. This research also aims to inform local governments, policy makers and planning agencies of the value and use of POS to guide the provision of POS specific to the needs of differing residential zonings.

1.5 Research questions

My study will answer the following questions:

1. In high- and low-density communities:
 - a. How important is public open space to residents?
 - b. What qualities of public open space are most important to residents?
 - c. What activities do residents undertake in public open space?
 - d. What is the level of use of public open space and how does this vary?
2. What socio demographic factors influence the qualities and activities undertaken in public open space?
3. In all communities, does a high self-reported health status compared to a low self-reported health status impact on how the participant values and uses public open space?

1.6 Conclusion to the chapter

This chapter provides the background to my study and has identified the need to better understand how residents in high- and low-density communities value and use POS. The context of the study has been identified, along with its significance to both the health and planning industry in Australia. The research questions that were answered during my study have also been presented in this chapter.

Chapter 2: Literature Review

2.1 Introduction to the chapter

This chapter explores and critically examines key literature related to the value and usage of public open space (POS). Key literature is explored through a number of topics, including: how high- and low-density communities can be defined across a number of varying contexts; the relationship between population and housing density; the many benefits of public open space (POS); how POS is planned and provided; and the advantages and disadvantages of high-density living.

2.2 Background

Major cities in Australia are experiencing dramatic increases in population density (NSW Government Department of Planning and Environment, 2018). The setting of my study is within the Blacktown local government area, located on the western outskirts of Sydney, NSW, Australia. The population of this area is projected to increase within a twenty-year period from 350,000 people in 2016 to over 520,000 people in 2036 (NSW Government Department of Planning and Environment, 2018b). With this increase in population density, public infrastructure must be provided to support growth. To house the additional 170,000 residents within the Blacktown local government area, the NSW Government Department of Planning and Environment (2018b) project that an additional 66,000 dwellings must be built in the area to house this growing population. Due to the advantages of providing high-density housing, many of these new residents will be housed in high-density living surrounding transport and service hubs, rather than the traditional sprawling urban development typically seen in Blacktown suburbs (.id, 2016).

The NSW Government Department of Planning and Environment (2018a) recognises that supporting infrastructure is required alongside housing developments to provide essential

services such as roads, electricity and water. Whilst the provision of housing and supporting infrastructure is identified as essential, the NSW Government Department of Planning and Environment are yet to suggest a required provision level for additional POS to support these communities. POS is open green space which can be utilised for recreation or sporting activities (Blacktown City Council, 2018). POS can be used for sport and recreation, socialisation or for relaxing and unwinding. POS is infrastructure which is accessible to every community member regardless of age, gender, ethnicity or socio-economic status. If planned well, POS has limited barriers for usage.

POS is a crucial element to enhance a resident's health and wellbeing, therefore, it would be advantageous to better understand how residents use and value this space. Currently there is no documented literature identifying whether living in high or low-density communities changes the way that residents value and use their nearby POS. Provision standards and guidelines for POS have historically been determined without consideration of the surrounding population density. The lack of an accepted standard of POS provision within Australia's urban planning industry has allowed varied provision levels to be applied in similar planning scenarios (Byrne & Sipe, 2010). This has resulted in disjointed and irregular provision of POS which can be detrimental to the health of many communities (Searle, 2011). Disjointed provision levels leaves urban planners unsure about what provision should be required in their own communities. The aim of my study was to determine the value that residents within the Blacktown, NSW local government area place on their nearby POS, and if this value differs between residents in high-density and low-density living. This will allow planners to further understand a suitable provision level dependent upon density.

2.3 Public open space benefits

POS can have a number of positive impacts on a population when planned well, with consideration to the wants and needs of the population. POS has the ability to positively

impact the health, social, economic and environmental outcomes within a community. In order to understand these impacts, POS must be clearly defined.

2.3.1 Definition of public open space

POS is known by a number of varied terms within previous research in the urban open space field. These terms include public green space, public gardens, parks, green open space, urban green space or simply open space (Rakhshandehroo, Afshin, & Mohd Yusof, 2017). Each term is not necessarily synonymous with a particular industry or body, rather the terms can be interchanged without confusion to the topic when discussed in the design, management, planning and policy realms. Within the realm of POS, the land can be further broken down into categories which are often dependent upon size, characteristics, ownership and use (Government of Western Australia, 2012). When considering POS in both national and international contexts, the recurring concept is that POS is simply open space covered with some kind of vegetation, whether it be natural or planted (Rakhshandehroo et al., 2017). As there is no overarching framework to classify POS, this is usually undertaken at a local government level and tailored to the wants and needs of each community.

For the purpose of this study, the definition of POS, accepted by Blacktown City Council will be adopted. It defined POS as council land available primarily for recreation or sporting activities. This definition includes council-owned land, council-managed land and state government land (Blacktown City Council, 2017).

2.3.2 Health benefits of public open space

In 2015, almost two thirds of the Australian population were overweight or obese (Australian Institute of Health and Welfare, 2017b). Trends evident in Australian census data indicate that the occurrence of people being overweight and becoming obese is expected to increase in the future (Australian Bureau Statistics, 2013). Benefits of open space extend to

increased physical activity levels in children, adolescents, adults and the elderly (Mowen, 2010). Being well connected to aesthetically pleasing open space is likely to increase residents' physical activity levels, through options such as organised sporting activities, walking, exercising the dog or enabling children to play outside (Rofe & Kellett, 2009). A study conducted by Sallis et al. (2016) across 10 countries - Belgium, Brazil, Colombia, Czech Republic, Denmark, China, Mexico, New Zealand, the United Kingdom and the United States - involving 6,822 participants, measured physical activity levels using accelerometers over a one week period. Data related to POS amount, type and location were analysed using geographical information systems. The Sallis et al. (2016) study concluded that when POS is well-connected to other services and infrastructure, residents experience higher levels of walking for the purposes of both physical activity and transport (Sallis et al., 2016).

Picavet et al. (2016) agree that having more POS in an urban environment encourages physical activity through cycling and sport, however, a 25-year longitudinal study (Picavet et al., 2016) which used a similar method of geographical analysis of POS near homes in the Netherlands, found that there was no relationship between an increase in POS provision and physical activity (Picavet et al., 2016). The authors identify that this could be due to other limiting factors such as walkability, environmental factors and lack of accessibility to shops and services in the study area. These limiting factors were further explored by Lowe et al. (2014) who found that an increase in physical activity directly encouraged by POS, as well as other planned features such as street connectivity to essential infrastructure and service connections, has the ability to decrease the prevalence of a number of risk factors related to chronic disease (Lowe et al., 2014).

Physical activity is identified as a major contributor to the prevention of up to 35 chronic conditions (Booth, Roberts, & Laye, 2012). Any increase in physical activity, as

often associated with POS provision, may be beneficial for reducing the prevalence of chronic disease in Australia. The chronic conditions can be categorised as “loss of functional capacities with chronological aging; metabolic syndrome, obesity, insulin resistance, prediabetes/type 2 diabetes, non-alcoholic liver disease, cardiovascular diseases, cognitive functions and diseases, bone and connective tissue disorders, cancer, reproductive diseases, and diseases of digestive tract, pulmonary, and kidney” (p. 1144). Chronic diseases are the largest cause of illness, disability and death in Australia (Australian Institute of Health and Welfare, 2017a). Each year, 90% of all Australian deaths are due to chronic diseases. Of these diseases, 60% of all deaths occur from cardiovascular disease and cancer. The most common chronic diseases in Australia are cardiovascular disease and mental health conditions (Heart Foundation, 2017).

Of large concern, diabetes is the fastest growing chronic disease worldwide. The population of Western Sydney is particularly vulnerable to this condition, with prevalence rates 1.5 times higher than the Sydney average (Western Sydney Local Health District, 2016). The Western Sydney Diabetes Prevention Strategy, developed by the Western Sydney Local Health District (2016), identifies increasing physical activity and building healthy environments as priority areas to reduce the prevalence of diabetes. Both of these priority areas can be positively impacted by the provision of POS for the wider community. Although POS provision has the ability to improve levels of physical inactivity, which is associated with a number of chronic diseases, it is important to consider the range of other determinants and factors which may also increase or decrease an individual’s susceptibility to chronic diseases.

An interesting association has been made between POS and Body Mass Index (BMI) which has been widely explored by researchers aiming to identify the type of relationship between the two elements. BMI uses height and weight data to place individuals into

underweight, healthy, overweight or obese categories (Heart Foundation, 2018). These data can then be used to assess risks for other chronic diseases such as type 2 diabetes, heart disease or obesity. It is important to note that BMI is only a guide, and does not take into account age, gender, ethnicity and body composition when determining risk factors (Heart Foundation, 2018). Despite the limitations in the relevancy of BMI to determine the unique health status of an individual, it is widely used as a simple tool to establish health status across a population (World Health Organisation, 2018).

A longitudinal study of 4,423 Australian children initially aged 6 - 7 years old collected BMI data every two years for eight years (Sanders, Feng, Fahey, Lonsdale, & Astell-burt, 2015). Through tracking changes in BMI and accessibility of nearby greenspace, an inverse relationship was found between BMI and age. As children grew older, the availability of green space had a positive effect on their BMI (Sanders et al., 2015). Similarly Astell-Burt, Feng, and Kolt (2014) conducted a study on an Australian adult population over 45-years-old, where BMI was used to assess weight status. The study determined that green space promoted physical activity and reduced sedentary behaviour, especially in women (Astell-Burt et al., 2014). In comparison to the Astell-Burt et al. (2014) study, a contradictory finding was identified by Müller, Harhoff, Rahe, and Berger (2018), who conducted a cross sectional study involving 1,312 participants in an urban German city. Müller et al. (2018) did not find an association between green space and BMI. However, Müller et al. (2018) did find that indicators of low amounts of green space were associated with 2.44 times higher likelihood for residents to have type 2 diabetes. These studies confirm that POS has the ability to impact BMI both positively and negatively, leading to changes in long term health.

An Australian study by Astell-Burt, Feng, and Kolt (2013) and a study conducted in New Zealand by Nutsford, Pearson, and Kingham (2013) have shown through similar methods, that POS can decrease psychological distress by enabling people to participate in

recreational activities, physical activity, socialise, or provide a space to mentally recoup alone. Both studies analysed the proximity and amount of POS close to residents that had presented with mental health issues. Astell-Burt et al. (2013) found that POS can decrease psychological distress in older residents of NSW and the increase in the quantity of green space showed that residents were more likely to be physically active and have improved signs of mental health. POS has the ability to positively impact mental health conditions through providing a space for an increase in physical activity, and a space to socialise or relax, leading to improvements in symptoms associated with mental health conditions.

Nutsford et al. (2013) found that having more useable POS near an individual's home was associated with the decreased presentation of symptoms related to anxiety and mood disorders. However, Francis, Wood, Knuiman, and Giles-Corti (2012) found that the quality of POS, measured by factors such as atmosphere, comfort, safety, attractiveness, maintenance and variety of things to do, was more important than quantity, to decrease signs of psychological distress. Simply taking a walk within POS can relieve tension, improve mood and reduce symptoms of depression (Bragg, Wood, & Barton, 2013). The health benefits associated with providing POS translates into people living longer, being less stressed and avoiding illness and chronic conditions related to weight gain such as type 2 diabetes and coronary heart disease (Byrne & Sipe, 2010). In practice, these studies suggest that POS provision does not have to be in high quantities to positively impact mental health conditions. POS should, however, be well-planned with consideration to additional features and functionalities which attract resident to use the space, providing a positive impact on health conditions.

2.3.3 Social benefits of public open space

In addition to physical and mental health at an individual level, POS can positively impact residents socially at both an individual and community level. Communities can use

POS to meet and gather together, whether through organised events or incidental social interactions such as passing by a neighbour on a walk (Rofe & Kellett, 2010). Neighbours can meet and communicate with each other in a friendly and comfortable environment in POS. On an individual level, this creates a sense of belonging and security within a neighbourhood as support mechanisms are created. Bull, Hooper, Foster, and Giles-Corti (2015) surveyed 2,000 new home owners moving into new strategically designed liveable neighbourhoods in Perth, Western Australia. Surveys were conducted four times over 10 years from before relocation, to seven years after living in the new community. A consistent theme was found between well maintained and aesthetically pleasing POS and community attachment. Bull et al. (2015) suggest this is due to the value placed on the positive lifestyle impact POS provided the neighbourhood. The ability to interact with others and build relationships, has long lasting effects on both physical and mental health, which is encouraged through the use of POS.

Open spaces can also impact on a community if the space is considered to be culturally significant. The cultural impact could be due to the historical significance of the area, where special events took place or certain significant people have lived in the past. Open spaces can be considered sacred to some cultures who hold personal connections to nature, or the flora and fauna that exists in the space. The cultural or historical significance of a POS can be demonstrated by the presence of monuments and plaques to commemorate these spaces, or the existence of historical physical elements (Amin, 2009). POS has the ability to preserve flora and fauna for future generations, and preserve species that are biologically significant to create a landscape that continues to be biologically diverse.

Finally, POS provides the opportunity to develop a social culture within a population that brings communities together (Regional Public Health, 2010). Australia has a sporting culture which has become intertwined in society through the work of elite athletes, grass

roots sporting participation or simply watching and following sport as a devoted follower (Rowe, 2016). Whether being used for sport or physical activity, or simply socialisation with friends or neighbours, POS provides a space outside of the home where people can gather and communicate. Historically, these spaces have been designed around engaging a culture and bringing strangers together to build a social network (Amin, 2009). It is important for open space planners to consider that nature and aesthetics are elements that - regardless of density - are valued by all residents and include this awareness in their design considerations.

2.3.4 Economic benefits of public open space

From an economic perspective, POS creates positive flow-on impacts by providing opportunities to increase physical activity. Chronic diseases contribute to a large financial burden on the Australian healthcare system (Australian Bureau Statistics, 2012). In 2013-14, 50% of the Australian population was reported to have a chronic disease (Australian Institute of Health and Welfare, 2018). The Australian Institute of Health and Welfare undertook the Australian Burden of Disease study in 2011. This study found that 7% of all health issues within in Australia was due to obesity (Australian Institute of Health and Welfare, 2018). An increase of only 15% in an individual's physical activity level, could benefit the Australian economy \$434 million annually (Ananthapavan, Magnus, & Moodie, 2014).

Economic benefits are also associated with increased house values identified where POS is available within walking distance to a home, as people appreciate the benefit of large attractive POS (Brander & Koetse, 2011). Economics and health was also linked in an Australian study by Atalay, Edwards, and Liu (2017). The researchers recognised that when housing prices increase, so too did the home owner's physical health. This is described as being due to a larger investment in health-related activities and less time spent at work (Atalay et al., 2017). The economic benefits of POS are numerous and should be considered

an important influence on long term positive effects on the Australian health care system, by reducing the burden of chronic diseases within the Australian society.

During times when government initiatives worldwide are encouraging people to take responsibility for their own health and wellbeing through maintaining a healthy lifestyle, POS plays an important role by being a free publicly accessible resource to assist with reaching health and lifestyle-related goals, leading to less pressure on the healthcare system (World Health Organisation, 2012). Providing POS is a way that local governments support the Australian Medical Association's position on physical activity and improving accessibility options for the wider population (Australian Medical Association, 2014). Local governments have a responsibility to provide safe and accessible opportunities for both planned and incidental physical activity. POS is an asset that is accessible by all people regardless of age, gender, socio-demographic status, cultural background, occupation or level of education (Australian Medical Association, 2014).

When planned well, POS can also add economic benefits to a community by attracting visitors to the destination for an active and interesting ecotourism experience or sport and recreational tourism experience (Aldous, 2010). Without the provision of POS, which allows both children and adults to develop sporting skills, the \$12.8 billion annual contribution that sport and recreation produces for the Australian economy would not be possible (Clearinghouse for Sport, 2019).

2.3.5 Environmental benefits of public open space

POS provides an essential part of the natural ecosystem for flora, fauna, waterways and natural conservation. Areas of green space, such as POS, can “filter air, remove pollution, attenuate noise, cool temperatures, infiltrate storm water, and replenish ground water” (Wolch, Byrne, & Newell, 2014, p. 235). In addition, green space can assist with

“controlling soil erosion, filtering pollutants and other particulate matter, reducing wind speed impact, stabilising dust and reducing glare, reducing sound and visual pollution, providing security from calamities such as fire and earthquake” (Aldous, 2010, p. 12).

POS has the ability to preserve nature and native plant and animal species, to make an ecosystem biologically diverse. Esbah, Cook, and Ewan (2009) conducted a 40-year time series analysis of changing urban spaces in Arizona, USA. Through the use of landscape metrics, such as measures of adjacent land uses, isolation from other green spaces and connectivity to other green spaces, the researchers identified that the increasing pressures of urbanisation can have a negative impact on the existing ecosystem in open spaces. Preservation of these areas, as well as consideration to connectivity between open spaces to create accessible nature corridors, is essential to maintain the diversity of plant and animal species.

Australia has a number of areas that have been identified as urban heat islands. Urban heat islands are areas that are significantly hotter than others surrounding, and can be attributed to a higher density population and the associated activities of people. Low-density sprawling cities such as that of Western Sydney, have high urban heat islands due to the lack of vegetation in the local area (Deilami, Kamruzzaman, & Hayes, 2016). The cooling effect of POS is evident in a study by Park, Kim, Lee, Park, and Jeong (2017) measuring temperatures at ground level of six residential blocks in South Korea. This study found a significant link between small amounts of green space and cooling temperatures that reduced the solar radiation that creates heat islands experienced in warm climate cities (Park et al., 2017). This cooling effect has also been shown to reverse as soon as green space is reduced (Sun & Chen, 2017). When considering this literature from the environmental field, the provision of sufficient POS has the ability to reduce the impact of heat in the Western Sydney

Area, along with providing a number of positive impacts to the local ecosystem which has been impacted by the high level of population density in the area.

This section has explored the benefits of POS and the potential impact on health, social elements of the community, as well as economic benefits and environmental sustainability. It is essential for planners to understand the ability of POS to either positively or negatively impact on each of these elements, when considering the location, size and detail of POS provision.

2.4 Public open space planning and provision

In order to create a positive impact on a community, POS must be planned well, with details considered such as size, location, accessibility, features or characteristics and infrastructure. Each of these elements will have a lasting impact on the surrounding community either in a positive or negative way.

2.4.1 Provision standards

After considering the many benefits of POS, it is surprising that there is no current, up-to-date and accepted industry benchmark for the provision of POS in Australia. In NSW, a provision of 2.83 hectares of POS per 1,000 people has been widely accepted, however, this is an out-of-date guideline developed in the early 1900's for provision of POS in the United Kingdom (NSW Department of Planning, 2010). The use of this standard has been questioned since the early 1970's, as it does not consider factors such as type of open space, size, location or surrounding population characteristics (Byrne & Sipe, 2010). Searle (2011) also questions how a standard that was created almost 100 years ago for POS provision in London is relevant to the modern-day Australian population:

It is perhaps difficult to believe that the Australian apartment resident today would need less open space than was considered desirable for the average resident of London

in the 1930's, but this is the assumption that is now being built into urban consolidation planning across much of Sydney (p.17).

There is a substantial discrepancy in the provision of POS within the Sydney area. Inner city suburbs with higher density housing consistently provides less than the NSW benchmark of 2.83 ha per 1,000 people whereas, the outer city suburban areas often provide above this benchmark (Searle, 2011).

Individual local and state governments often determine their own standards for open space provision to which they adhere. In Western Australia, the Department of Local Government, Sport and Cultural Industries supports a provision standard of 16m² to 19.5m² per resident (Department of Local Government, 2017). However, an accepted standard among many areas of South East Queensland is the provision of four hectares of POS per 1000 people (MAK Planning and Design, C Change Sustainable Solutions Pty Ltd, & John Wood Consultancy Services, 2015). In Queensland, this equates to 100m² per resident, a provision level almost five times higher than that of Western Australia. The number of differing standards applied demonstrate the wide variations in open space provision levels across the country.

Rofe and Kellett (2010) propose the planning industry moves towards a model of provision based on the wants and needs of a population, rather than a pre-identified blanket standard (Rofe & Kellett, 2010). Strength is apparent in this model, as localised standards or models can better capture changes in population or demographics and therefore, provide open space accordingly. Despite these important characteristics, Australia continues to base their POS planning on state wide standards rather than needs- or demand-based models (NSW Department of Planning, 2010).

In an effort to house the growing population of Sydney, the NSW Department of Planning and Environment has allowed local governments to decrease the minimum lot sizes for housing developments to allow more dwellings to be built in a smaller area. It is also fast-tracking development applications to ensure housing is provided quickly, and encouraging local governments to meet housing supply targets (NSW Department of Planning and Environment, 2018). The reduction in lot size has resulted in the decrease of private open space in the form of smaller or no backyards. In addition to the actions of the Department of Planning and Environment, high-density hubs surrounding railway stations have been identified to accommodate this growth (Spencer, Gill, & Schmahmann, 2015). This direction by the Department of Planning and Environment has not taken into consideration balancing this reduction with the provision of POS.

Although identified as important, a guideline for provision is yet to be recognised by the Department of Planning to ensure that this vital space is provided in the development stage. If a guideline is not provided, it becomes difficult for local governments to enforce a level of provision when they are faced with opportunities for housing developers to make financial gain, or the provision of other necessary services such as water, sewer or road infrastructure (Searle, 2011). Searle (2011) identified that, under provision of POS in Sydney has already shown to be of most concern in higher density areas. Due to the lack of supporting infrastructure provided in historical high-density developments in Sydney, there is often a public perception that high-density developments will have a negative impact on the city (Ruming, 2014). High-density living is recognised in the literature as only successful when a holistic approach is considered with supporting infrastructure, such as sufficient POS provision (Rofe & Kellett, 2010; The Committee for Sydney, 2016; Udell, Daley, Johnson, & Tolley, 2014).

Koohsari et al. (2015) suggests that the lack of a unified POS provision standard could be due to the varied evidence reported in previously published research on open space characteristics, and how these either positively or negatively affect health. When investigating literature about POS provision standards, there is not one consistent finding that is substantiated enough to form the basis of the development of this standard. Further research in this area will generate a greater pool of evidence on which to base planning decisions about how POS should be provided in the future.

2.4.2 Open space characteristics

When planning for POS, consideration must be given to factors which make the space both usable and attractive. Simply providing an amount of POS does not necessarily translate into usage of the POS (Veitch et al., 2014). In order to have a positive impact on physical activity level and health, Jalaludin and Garden (2011) note that neighbourhoods must be “safe, open, engaging and aesthetically pleasing” (p. 275). The design features chosen when planning POS contribute highly to the feel of a neighbourhood and how the space is utilised by the nearby communities (Bull et al., 2015).

Accessible POS that is well located with connectivity to other infrastructure or services, encourages intentional recreational walking as well as walking and cycling for transport (Knuiman et al., 2014). Furthermore, a lack of accessibility in the form of uneven footpaths, lack of connections, poor signage or long distances without resting points, provides barriers for groups such as older adults, people with disabilities or people with prams to enjoy POS (Rofe & Kellett, 2010). An increase in movement throughout POS also increases a sense of safety and surveillance across the area. To encourage this movement, local governments and planners need to consider all accessibility elements such as lighting, pathways and access points so that flow on effects of safety and security can be achieved.

Adherence to the principles of the Crime Prevention through Environmental Design (CPTED) framework for POS is desirable (Department of Urban Affairs and Planning, 2001). Precautions such as ensuring adequate surveillance through open-street frontages, providing adequate lighting, ensuring activities can be managed in the space, as well as encouraging community ownership, removes opportunities that facilitate crime or anti-social behaviour. This ensures POS users feel secure whilst in the space (Department of Urban Affairs and Planning, 2001). Accessibility is only one of many important elements to encourage use of POS.

POS must also have adequate supporting facilities that encourage visitors to either engage in physical activity or stay for extended amounts of time in the space, or do both.. Kaczynski, Potwarka, and Saelens (2008) found that having more features, such as drinking fountains, toilets, picnic tables, seating or landscaping encouraged visitors to participate in physical activity. Of all factors considered, the availability of tracks and trails through the POS was shown to have the strongest relationship with physical activity. Diverse and engaging opportunities are often achieved through the provision of multi-use sporting grounds and recreation areas where the whole community is encouraged to engage in the space (Zhang & Lawson, 2009). Zhang and Lawson (2009) conducted an observational study in a number of public open spaces within high-density areas of Brisbane, Australia to determine the varying uses of POS. Activities conducted within the selected spaces were observed over a number of sessions at varying times and days. Observations concluded that the design of POS is essential to encourage residential use of POS. However, the implications of this study were limited as observations were only conducted at three locations during short time frames over four days. This did not allow for variables such as seasonal changes, spatial characteristics or external factors, such as location in relation to other services.

Initiatives by the Singapore Government can be viewed as an example for well-planned and provided POS in high-density residential developments (Menz, 2014). After dramatic increases in population within a very small geographical footprint, the Singaporean Housing Development Board developed recommendations which have been implemented in 26 new neighbourhoods regarding the type of POS that should be provided (Menz, 2014). These recommendations suggest that POS should provide for: seating and interacting; playing and exercising; eating; gardening and farming; and gathering and events. The development of these recommendations shows a clear and planned approach that covers all potential uses of POS to ensure the health and wellbeing of residents living without access to private open space. In an Australian context, a similar position has been established by the South Australian Government.

The South Australian Government has acknowledged the importance of well-designed POS in high-density areas, and has formed a Green Public Space Reference Group which combines the expertise from invested parties such as the Department of Health and Ageing, The National Heart Foundation, Environment Water and Natural Resources, Office of Recreation and Sport, the South Australian Local Government Association and the Office of the Chief Architect (Government of South Australia, 2016). This group was formed to achieve the vision of providing green space across the state that is well designed, planned, delivered and managed, to support health, wellbeing, biodiversity and ecosystem outcomes.

The actions of both the Singapore Government and the South Australian Government (Government of South Australia, 2016; Menz, 2014) demonstrate the topic of POS within a government context is becoming of increasing interest to planners, and the POS planning industry is gaining recognition of its importance regarding the potential positive or negative impacts on a communities' health. The formal adoption of strategic directions to guide the

POS industry to collaborate with other industries such as environment and health, is a positive step towards a consistent understanding of POS provision standards.

Previous research has reported extensively on the design of POS (Bull, 2015; Jalaludin, 2011; Rofe, 2009; Veitch, 2014), however, a gap in previously published research has been identified when considering the differences in how high- and low-density communities value these spaces. It is clear from the extent of design research, that attracting usage is an important factor for the health of communities, however a deeper understanding about what is valued within the space is not yet apparent.

2.4.3 Distribution and categorisation

In addition to the quality of POS, planners must consider the quantity of provision including size and the distribution of POS across their area of control. Similar to provision levels of POS, there is no unifiable benchmark across the planning industry indicating the acceptable distance for a resident to travel to use POS. At a local government level, distance to POS is often determined using a hierarchical structure. POS is commonly categorised according to the level of population it services. For example, local neighbourhood parks may be located 400m from residents; however regional parks could be up to 8km away (Rofe & Kellett, 2009). It is also desirable to have local POS within walking distance of all residents. The most commonly used distance considered to be walkable for the majority of the population is 400m, which corresponds to a five-minute walk (Herzele & Wiedemann, 2003).

In order to test varying theories of POS distribution, Hooper, Boruff, Beesley, Badland, and Giles-Corti (2018) analysed 16 different POS planning guidelines from varying areas around Australia. These planning guidelines were compared with health data from the RESIDE survey, which included data related to physical activity levels and walking patterns. Hooper et al. (2018) concluded that the only POS planning guideline that was related to

positive health impacts for the community was the proximity of residents to POS. Residents living in suburbs where 95% of the population was living within 400m of a park, were three times more likely to participate in moderate physical activity.

In comparison to the findings of Hooper et al. (2018), Yang and Diez-Roux (2012) found that walking distance is dependent on the individual's reason for the trip, and varies between socio demographic characteristics such as age, gender and income level. The variety of distribution standards could be due to limited and contradicting literature exploring the reasoning behind these practices or standards. Because of the apparently opposing results of these two studies (Hooper et al., 2018; Yang & Diez-Roux, 2012), provision standards could be further explored through future research.

Coombes, Jones, and Hillsdon (2010) support the concept of POS usage in relation to distance travelled in their survey of over 6,000 adults in the United Kingdom, combined with open space location and typology data from geographical information systems. Survey data showed that frequency of POS usage increased with proximity to the participants' places of residence. An increase in physical activity also remained when variable factors such as socio-demographic characteristics, economic and neighbourhood characteristics were accounted for (Coombes et al., 2010). This literature identified a number of varying characteristics which must be considered when preparing a standardised provision and distribution process. This would create uniformity across local government areas, which would give planners the ability to provide a consistent platform working towards healthier cities.

Variations in research outcomes are also apparent when considering the impact of POS and life satisfaction. In a German study of populations in high-density urban environments, Bertram and Rehdanz (2015) found an inverted U-shaped relationship between life satisfaction and distance to open space. When POS was extremely close to housing, life

satisfaction was low. Life satisfaction then increased as distance from POS did, however, it then started to decrease as POS distance was too far away from residents to easily access. Bertram and Rehdanz (2015) propose that the initial drop in life satisfaction could be due to a fear of crime, congestion or the noise associated with living too close to POS. In contrast, Herzele and Wiedemann (2003) found that “people who live in close proximity to a green space use it frequently, those who live further away do so less frequently in direct proportion to the increase in distance” (p. 111).

In a study commissioned by The National Heart Foundation in Australia, Giles-Corti, Ryan, and Foster (2012) developed a pyramid (See Figure 1) to describe the key factors required to develop healthy high-density living communities. Of most impact, found at the bottom of the pyramid is the provision of employment opportunities consistent with the population density. The base layer of the pyramid relates to either over or under crowding a space with population, and the ability to provide employment for these people within the local area. The next layer of the pyramid is the provision of high quality POS, transport opportunities, and vibrant and functional design (Giles-Corti et al., 2012). This layer of the pyramid relates to the associated elements that make a community functional and attractive. Consideration of these elements of POS, transport and design create a space in which people feel comfortable, safe and engaged. Each of these elements has the ability to impact the other, as well as improve basic human needs, and the ability to use active transport options. If all features of the pyramid are considered, the outcome is a healthy high-density community.

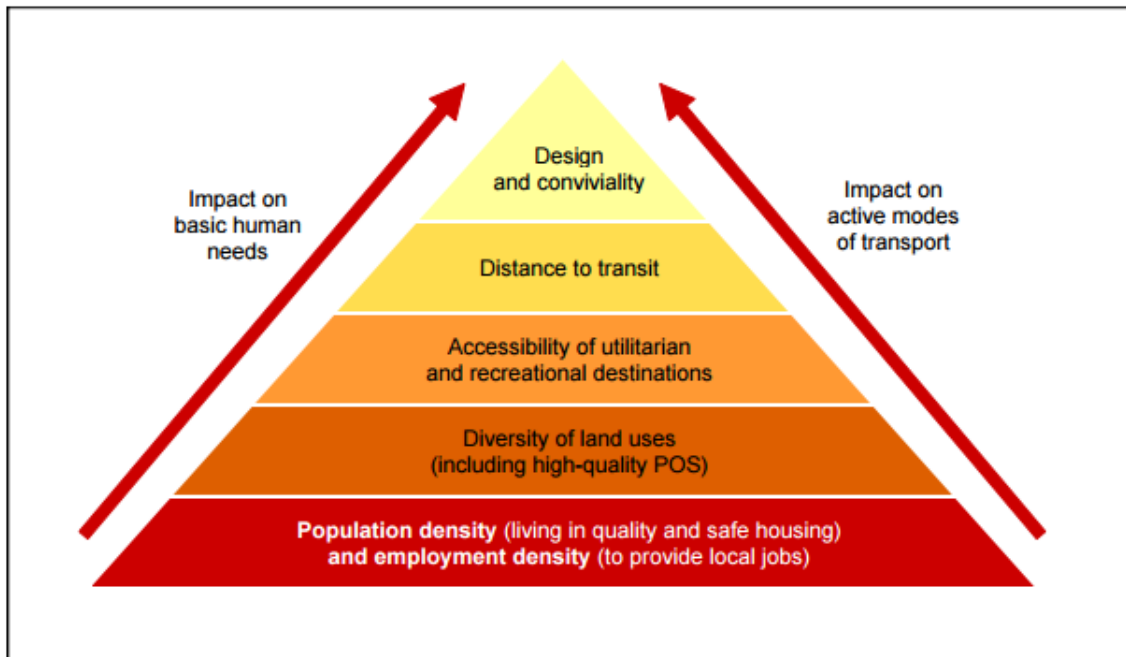


Figure 1. Pyramid of key Factors for healthy high-density communities.

Foster, Gronda, Mallett, and Bentley (2011) also explored the idea that there are a number of elements of housing that affect health status. Figure 2 illustrates a theoretical model identifying the potential housing elements and how they connect to mental health, physical health and wellbeing. Figure 2 identifies that each element of housing, including security, neighbourhood, shelter, ability of housing to meet household needs, suitability of housing and housing type, all have an intertwined impact on the varying elements of health (Foster et al., 2011). The interconnection between mental health, physical health and wellbeing as displayed in Figure 2 validates that it is important to consider all of these elements when planning well designed POS to maintain the health of a population.

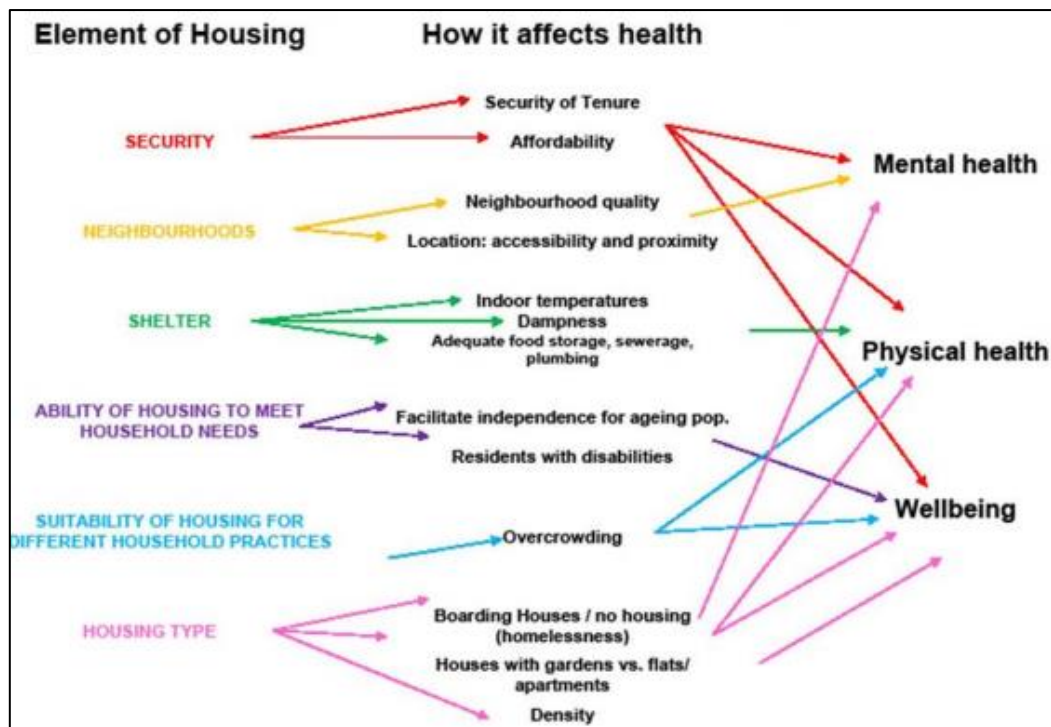


Figure 2. Housing effects on health.

Reprinted from “Precarious housing and health: research synthesis,” by G. Foster, H. Gronda, S. Mallett, and R. Bentley, 2011. Australia: Australian Housing and Urban Research Institute.

The understanding of how POS should be distributed is considered as a whole community approach, however, a gap in the research concerning POS distribution is identified when considering whether the distribution of this space should be different between high- and low-density communities to facilitate positive health outcomes. To further understand the relationship between density and POS provision, the question as to how these communities value and use POS to determine their distribution requirements, must be addressed.

2.5 Definition of high- and low-density communities

Population density can be measured in a number of ways, however, the outcome of all measurements depicts how crowded or sparse a unit is over a selected area of land (Boyko & Cooper, 2013). In the urban planning industry, dwelling and population density is of the

most concern. This research is concerned specifically with urban development density. Common measures of urban development density include population per dwelling, floor space per dwelling or simply population per hectare (Boyko & Cooper, 2011). There is no nationally agreed definition or measure of population density in Australia. In NSW, the Department of Planning and Environment measures density using a dwellings-per-hectare approach (NSW Government Department of Planning and Environment, 2016) and Blacktown City Council also adopts this approach. For the purpose of this study, density will refer to dwelling density per hectare. An accepted categorisation of dwelling density is indicated in Table 1 (Byrne & Sipe, 2010).

Table 1.

Definition of low, medium and high-density

Low-density	1-29 dwellings per hectare
Medium density	30-65 dwellings per hectare
High-density	>65 dwellings per hectare

2.6 Population and housing density

The way in which cities provide for a growing population is changing and therefore, urban consolidation is resulting in more inventive and creative ways to provide POS. Currently, two thirds of the Australian population live in capital cities (Australian Bureau Statistics, 2014). In NSW alone, 63% of the population live within 100km of the Sydney city centre (Australian Bureau Statistics, 2010). Urban consolidation is proposed as a response to the demand for increased housing and a solution to rapid urban growth as the population expands. Sydney already has the highest provision of high-density living in Australia (including 28% of residences in the country), doubling the national average of high-density dwellings for major cities (McCrindle Research, 2015). The current metropolitan plan for Sydney identifies an additional 664,000 new homes to be built in the next 20 years within

existing suburbs and newly planned centres (NSW Government Department of Planning and Environment, 2014). This expansion will include more open space, however, the plan does not propose where or how this will be provided at a local level (NSW Government Department of Planning and Environment, 2014).

Although Sydney has the highest level of density in Australia, in comparison to other international examples such as London, Vancouver and Montreal, Australia has a relatively low-density (Spencer et al., 2015). Outer Sydney suburbs are still planned in a traditional sprawling nature, without supporting services or public transport infrastructure. These areas will be transformed into new community centres with higher densities and associated infrastructure provision which will dramatically increase the housing density of Sydney (NSW Government Department of Planning and Environment, 2014).

In a study conducted in an area of rapid growth where POS provision has been impacted by the growing density of the city of Guangzhou in south China, Jim and Chen (2006) surveyed 340 participants about their perceptions and attitudes towards green space in the city. The authors suggested that the historical loss of POS to urban development in this area may have increased the level of education and awareness about the ecological and recreational benefits of POS in the city. The impact of this higher level of education and awareness resulted in higher demands on recreational infrastructure due to the overcrowding of existing POS. The survey was limited in its validity due to the small sample size, which was to be representative of a large 3.22 million city population (Jim & Chen, 2006).

It is important for urban planners to look towards how POS will be impacted by the proposed increases in housing densities in areas of rapid expansion. In order to plan for this in the future, it is important to know the value residents place on POS and if this changes between the varying types of residential zoning. Government policy makers and planners will

then be able to utilise this information to determine if POS provision levels should change depending on the level of housing density. As detailed in this chapter, the planning and provision levels of POS have the potential to both positively or negatively impact the surrounding community, economy and environment. The context of rapid development being experienced in areas of Sydney brings this issue to the forefront of planners when considering population densities and housing types.

2.7 Advantages and disadvantages of high-density living

In order to cater for the population growth in Australian cities, high-density living is expected to increase. However, there are a number of advantages and disadvantages of high-density living to be considered. This section will detail both the advantages and disadvantages of high-density living.

2.7.1 Advantages of high-density living

Increasing densities and consolidation of residents in a small space has the clear advantage of managing a population boom by housing a larger population within a smaller geographical area. Providing more residences on a smaller land footprint ideally leaves more room to provide POS or other service infrastructure. However, this is often not the case when profit-driven housing developers aim to provide as many high selling residences as possible (Gifford, 2007).

Many benefits of high-density living are only achieved when considered in a holistic approach. This approach occurs when increased density is supported by design, accessibility, connectivity and a mix of land uses (Lowe et al., 2014; The Committee for Sydney, 2016). When supported by essential infrastructure, high-density living encourages healthy and active lives through an increase in active transport such as cycling and walking (Lowe et al., 2014). Bull et al. (2015) found that residents who moved into the newly developed higher density

neighbourhood in Perth, Western Australia were 54% more likely to use cycling as a form of transport than those individuals on the outskirts of a sprawling city.

An increase in active transport flows on to improve the efficiency of public transport systems as people depend less on private car use and walk or cycle to public transport hubs. An example of this is found where public transport systems located within walking distance to high-density areas that link residents to employment sectors, shopping centres or health services, are more attractive and used more by surrounding residents (Campoli, 2012). People who swapped their cars for public transport in Melbourne, Australia were found to walk 22 minutes a day more for transport than those who drove directly to work (Victorian Government, 2010). This increase in physical activity, due to walking indirectly, reduces risk factors associated with many chronic diseases (Lowe et al., 2014).

2.7.2 Disadvantages of high-density living

High-density living can be susceptible to a number of disadvantages when developed in isolation, or developed in an area that cannot be sustained by supporting factors such as employment, accessible transport and recreational spaces, as noted in Figure 1. Nearby infrastructure must have the capacity to handle a dense population, through provision of services such as roads, public transport, POS, retail, and medical services. An increase in population without consideration to infrastructure can lead to services becoming congested and overcrowded (Stevenson et al., 2016). The number of residents that share a small land area can experience reduced feelings of privacy, social support, which hinders the naturally occurring relationships often found in smaller communities (Gifford, 2007).

In a Canadian study comparing the different levels of noise in high-density apartments compared to low-density detached homes, King, Roland-mieszkowski, Jason, and Rainham (2012) found that the levels of noise in high-density areas were much higher and exceeded the

guidelines suggested by the World Health Organisation. However, the study is very limited in its reliability as noise level data were only collected over one 24-hour period. This allows for a number of external variables to influence results. The study indicated that the recorded noise levels could limit normal conversation and sleep. Excessive noise can be a trigger for stress and may lead to mental health problems (Gifford, 2007).

Socially, high-density living can cause residents to “feel alienated, have less social support, be less socially involved, have less sense of control, and encounter more people” (Giles-Corti et al., 2012). Even though residents living in high-density areas encounter more people, the prevalence of mental health issues is generally higher when compared to people living in low-density detached homes (Evans, Wells, & Moch, 2003). Sociologist Richard Sennett suggested this could be due to the popular theory that the closer people get to each other, the less they can like being with each other (Sennett, 1977). According to Giles-Corti et al. (2012) high-density living, specifically in high rise apartment style complexes, negatively impacted social experiences due to the lack of choice for some social interactions. They suggested that selective interactions, rather than forced encounters were shown to provide more positive social engagement.

2.8 Conclusion to the chapter

Based on this review of recent research concerning the value of POS, there are many positive impacts that POS has on individual health, the surrounding community and the wider economy. Research has identified the importance of, and advantages linked to, providing residents with adequate POS to support their specific wants and needs, which has the ability to provide positive impacts on residents’ health. Living in high-density areas exposes residents to a number of health and social disadvantages which must be considered when providing nearby POS. However, a gap in research about POS is identified in understanding how high- and low-density residents’ value and use their nearby POS.

The consideration of the rapidly developing population within Sydney brings with it issues that must be considered for planners dealing with these population increases. A deeper understanding of the impacts POS can have on their surrounding communities and their health will assist in determining the type and distribution of POS required for the needs of the surrounding neighbourhood. There is a clear gap in the literature exploring how high- and low-density residents value and use their nearby POS, and whether there are significant differences in their needs.

The proposed research questions, drawn from this review of recent research about POS, relate to how residents living in both high- and low-density communities, value and use their nearby POS. The topics of POS usage and value, as well as the relationship between sociodemographic factors and self-reported health data have driven the development of the research questions. These questions aim to identify whether there are differences between residential densities in the way that POS is valued and used. This leads on to a requirement for change in the way that they are provided. These questions were developed after understanding the current gap within the literature, will assist Blacktown City Council, and other local council areas to better plan for the increasing population across Sydney.

Chapter 3: Methodology

3.1 Introduction to the chapter

The methodology and study design used for this research will be outlined in this chapter. The first part of this chapter will include the study design and rationale, followed by an overview of the study setting, participants, data collection methods and the statistical methods used to explore and analyse the collated data.

3.2 Study design

The study was developed to answer the research questions, using a cross-sectional quantitative study where data were collected in the form of a survey. A cross-sectional study was chosen as the research questions aim to understand a particular group of people at a specific moment in time (Creswell, 2014). A survey was chosen due to the ability to gain a wide range of information in a succinct manner, with the ability for the researcher to collate data quickly within the time frame allocated for the study (Creswell, 2014). The determination of all of these elements of methodology were driven by the theoretical underpinning of my study.

When consideration was given to the potential theoretical underpinning of my study; it was evident that my study is a hybrid between health-based research and social science-based research regarding planning. Therefore, consideration was given to a number of theories in each of these disciplines. Health promotion theories are generally derived from particular research factors such as the specific health problem being researched, the population it affects and the context within which the study is taking place (Rural Health Information Hub, 2019). Health promotion theories are constantly refined and reviewed, which has led to an expansion in the concepts they cover from focus on the individual behaviour, to a wider understanding of the impact that social, economic and environmental

factors can have on an individual's health status (Nutbeam, Harris, & Wise, 2014). This concept is apparent throughout my study as my research aims to understand the relationship between POS and the way it is used by the individual and the high- or low- density community.

The first theory of consideration within the health planning and promotion frameworks is the theory of reasoned action and planned behaviour. This theory is based upon the suggestion that an individual's health behaviour is related to their own behavioural intentions, as well as subjective norms that are introduced through the social and environmental surroundings of the individual, and the chosen behaviour under consideration (Rural Health Information Hub, 2019). Furthermore, the theory also acknowledges the varying level of individual impulse to comply with the subjective norms related to the behaviour in question, as well as an individual's belief in their control over a behaviour (Nutbeam et al., 2014). The theory of reasoned action and planned behaviour proposes that if social norms are strong enough, they have the ability to influence behaviour choices of the individual if the individual feels pressure to conform. The use of this theory in health promotion is generally to develop programs with an understanding of the individual and their social and environmental surroundings to influence health behaviours (Nutbeam et al., 2014).

The use of some elements of the theories of reasoned action and planned behaviour could have been utilised within my research, as the data collection process aimed to gain an understanding of the social demographics of the research population and understand the values and perceptions of high- and low-density communities. By doing this, the research data from my study is used to gain an understanding of the social and environmental context in which the research is undertaken. The aim of the research was to understand the value and use of POS within high- and low-density areas, however, the scope of the research did not continue into the development of programming or the introduction of a change variable to

influence behaviour in any way. The findings of this research will, however, make recommendations that can be used in the future to implement changes to influence positive health behaviours.

A secondary theory of health promotion which was considered provided a foundation for my research was the social cognitive theory. This theory takes into consideration the social determinants of health and the impact these have on promoting change (Nutbeam et al., 2014). The social determinants of health which relate to an individual's behaviour change include: self-efficacy, or the belief that the individual can execute the behaviour; behavioural capability, or the belief that the individual has the skills to execute the behaviour; expectations of the outcomes of the behaviour; expectancies of the value of the outcome of the change; self-control over an individual's behaviour; observations of others completing the behaviour change successfully; and the reinforcement of the change to encourage long term adoption (Rural Health Information Hub, 2019).

When applying these factors to my research, applying a social cognitive lens may suggest that the value and use of POS could be changed through the observations of others, as well as positive reinforcements for use. Also to be considered, is the individual's self-belief and expectations for change (Bandura, 2004). Whilst my research is concerned with the values and perceptions of individuals, it does not capture data relating to behavioural changes. Therefore, it was determined that this theory does not specifically relate to my study.

After consideration of these two health promotion theories, further clarification of where this research sits within theoretical frameworks was required. Social science theories related to urban planning were contemplated as methodological approached for my research.

In application of the participatory planning model, the expectation is that the population involved is requested to submit their input into the planning process. The participatory planning approach considers all involved, including residents, community groups, policy planners and other involved agencies. Each participant or group is asked for their input and it is acknowledged in the decision-making process. The purpose of this approach is to create a feeling of ownership within the community, and identify a wide range of thoughts and ideas to be considered (Community Tool Box, 2018). The participatory planning model aims to ensure that the intervention determined is more suited to the population involved given their perspectives were considered throughout the planning process. This approach can be difficult when aiming to represent all individuals and groups throughout the planning process as some may be hesitant to be involved, or feel uncomfortable with the process. Within a true participatory planning model, consultation is a lengthy process which may not suit the context of the planning process required (Community Tool Box, 2018).

My research utilised participatory planning in a minimal way, as it considered a select population within the study area to be representative of a wider population. The research conducted gained responses on an individual level and did not have the scope to include specific community groups and their specialised interests. Therefore, my research can be considered a small part of a wider body of participatory planning research whereby the findings of my study are then utilised to further explore the requirements of a change in policy or procedure with planners who determine POS allocation within high- and low-density communities.

As my research is a nexus between social science and health, it does not derive from a single theory, and is rather a hybrid between health-promotion-based research and urban planning theories. Existing frameworks of health promotion, including the theories of

reasoned action and planned behaviour as well as the social cognitive theory, were considered as their concepts guiding the collection of data from wider populations to understand the context surrounding a health issue. The consideration of existing planning concepts, such as the participatory planning theory, were considered to guide the way that consultation is taking place and determine which groups are involved in voicing their opinions. Whilst none of these theories were suitable for the development of my research they assisted the development of my study. The theories which have some characteristics in common with my research - such as the theories of reasoned action and planned behaviour, social cognitive theory, and participatory planning theory - were important to have knowledge of due to their importance to both the health and urban planning industries.

3.3 Study setting

The setting for my study was Blacktown local government area (LGA), located 35km from the Sydney CBD, New South Wales, Australia. As the second largest local government area in New South Wales, Blacktown is home to over 347,000 residents (Blacktown City Council, 2016b). Spread over 240 square kilometres, the density of the overall area is quite sparse, with population density only reaching 14.48 people per hectare (Australian Bureau Statistics, 2016b). This is interspersed with areas of high-density surrounding major transport and service corridors. Blacktown includes 12 of the 16 new release precincts as part of the North West Growth Centre. The Australian Bureau of Statistics 2016 census identified that the Blacktown population is 50.3% female and 49.7% male (Australian Bureau Statistics, 2016b). The median age of the Blacktown population is 33 years of age, and each household averages 3.2 people (Australian Bureau Statistics, 2016b).

The North West Growth Centre is a coordinated housing and infrastructure delivery program developed by the NSW Government to address a rapid influx of population within Sydney (Department of Planning and Environment, 2017). It is expected that these

development precincts will draw an additional 200,000 residents to the area over the next 10 to 15 years resulting in rapid growth (Blacktown City Council, 2013).

The Blacktown local government area scores 974 on the Socio-Economic Indexes for Areas (SEIFA) scale (see Table 2). A score below 1,000 on this scale indicates a level of social disadvantage. The score for Blacktown indicates that the population has a lower level of tertiary education, a high level of employment in low skilled occupations, and a high unemployment rate as compared to the average scores across Sydney. Approximately 10% of the Blacktown population fall into the low income category, classified as being in the bottom 25% of incomes nation-wide (Australian Bureau Statistics, 2011).

Table 2.

SEIFA Index summary of Blacktown

Area	Score	Rank in NSW
Blacktown Local Government Area	974	93
Blacktown North	1068	175
Blacktown South-East	961	99
Blacktown South-West	891	11

Note. Adapted from “Blacktown City Social Profile 2016,” by Blacktown City Council. Copyright 2016 by Blacktown City Council. SEIFA = Socio-Economic Indexes For Areas. NSW = New South Wales.

The population of Blacktown is extremely diverse, with Australian and English ancestry being the most common, followed by Filipino and Indian communities, which make up almost 20% of the population. Of the residents in Blacktown, 30% speak a language other than English at home (Australian Bureau Statistics, 2011). The diverse population means that it is a priority of Blacktown City Council to ensure POS provision and distribution is adequate and accessible to the whole population. Health data specific to the Blacktown local government area is currently not available.

3.4 Ethical conduct and considerations

My study followed the guidelines presented in the National Statement on Ethical Conduct in Human Research (National Health and Medical Research Council, 2015) to ensure the safety and privacy of all participants throughout the design and conduct of this research. Research data remained confidential and individual participants were not identified in the results of the study. Within Australia, ethics committees are formed to ensure that the guidelines provided by the National Health and Medical Research Council (2015) are enforced and upheld.

In June of 2017, an application for ethical clearance of research project involving human participants was submitted by the researcher to Avondale College of Higher Education for consideration by the Avondale Human Research Ethics Committee (HREC). The purpose of the HREC is to protect the safety of human participants when conducting research. Specific consideration when an application is received, is given to: integrity, respect for persons, beneficence, dignity of participants, justice, consent, informed participants, research merit, safety, and storage and disposal of data (Avondale College Ltd, 2019).

Approval was granted for the research to be conducted by the HREC in July 2017. Evidence of this approval can be found in Appendix 3: Ethics approval letter. Approval was granted due to the consideration and processes undertaken to ensure the safety and consideration to the human participants in the research which was conducted in a low-risk nature (Approval number 2017:14). The researcher implemented the following actions to ensure that the study was conducted in an ethical manner.

The questionnaire distribution included an invitation to participate and detailed the intended outcomes of the research as well as the process of confidentiality and data security. Completing and returning the survey was considered as implied consent. The first question of

the online formatted survey also included a question requesting consent before the participant was able to continue to the following questions. Surveys were designed to ensure the participants' anonymity and residents were not affected in any way if they chose not to take part in the research.

Data were only accessible to Blacktown City Council and Avondale College of Higher Education for data analysis purposes. Data were retained electronically in a secure password protected database at Blacktown City Council Civic Centre, as well as on an electronic hard drive. Any hard copies received were stored in a secure storage at Blacktown City Council and will be retained for a period of two years before being destroyed. This is in line with the guidelines provided by the National Health and Medical Research Council (2015).

3.5 Participants

The target population of this research consisted of two groups. The first group consisted of people living in high-density residential environments in Blacktown, and the second group consisted of people living in low-density residential environments in Blacktown. A purposive sampling approach (Polit & Beck, 2017) was used to ensure results were representative of these two target groups through geographical zoning. Purposive sampling was chosen for my study as it allowed the research to focus on specific characteristics of a sample group to best answer the research questions (Polit & Beck, 2017). Purposive sampling allows the researcher to use their knowledge of the area to determine and then investigate areas of high- and low-density suitable to provide a sample. Multiple sample sites for each density category were selected to increase the generalisability of the results to the wider Blacktown population (Polit & Beck, 2017). The sample sites were geographically dispersed across the Blacktown area to accommodate any possible changes in population demographics within these areas.

Survey participants were specifically selected from geographical zones of Blacktown to be representative of either high-density communities or low-density communities. The areas selected for survey participation were identified through Blacktown City Council's geographical information system to be zoned as either *R4 High-density Residential* or *R2 Low-density Residential* (Blacktown City Council, 2017). The Blacktown Local Environmental Plan (LEP) 2013, characterises all land zonings in the Blacktown local government area. Land zoned as R4 High-density Residential is for the purpose of housing the community in a high-density environment in flats close to public transport hubs and centres. 'R2 Low-density Residential' is described as providing housing for the community in a way that does not affect the amenity of the neighbourhood (New South Wales Government, 2013). Therefore, for the purpose of this study, survey participants living in R4 zoned areas were categorised as high-density communities and those living in R2 zoned areas were categorised as low-density communities.

Data were collected from participants living in four geographical areas. Two areas consisted of dwellings in high-density zoned areas, and two areas zoned low-density. All residents within the selected areas were invited to participate in the same survey. As the research in question related to residents' perceived value of POS, the geographical areas chosen also required the presence of centralised POS within 500m walking distance of all residents surveyed. To ensure consistency, the size and features of the POS within all zones were also similar. All POS within the selected areas were considered to be a local park, contained some kind of children's play element, landscaping and shelter.

Figures 4 to 8 depict the four geographical zones for participants selected to be surveyed, as displayed on Blacktown City Council's geographical information system (Blacktown City Council, 2017). In these figures, green areas depict POS, red and pink areas

depict level of housing density, and yellow areas depict roads or other infrastructure. Figure 3 provides a mapping key for this information.

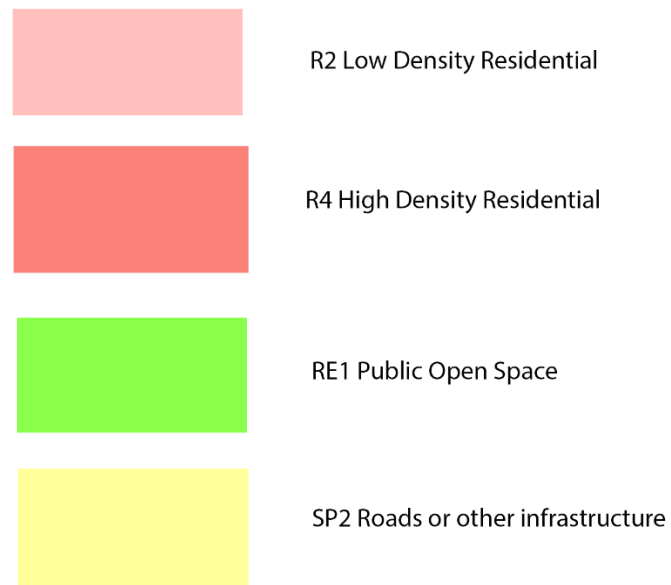


Figure 3. Geographical information system key

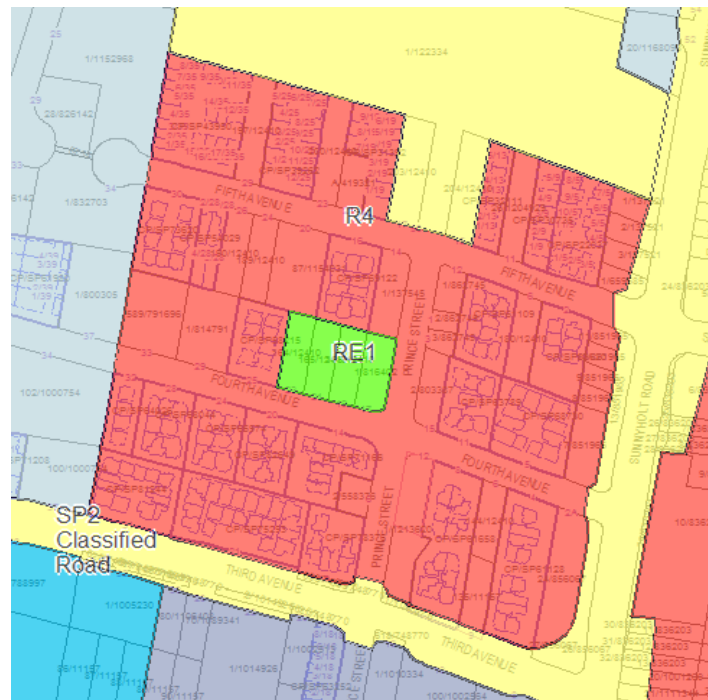


Figure 4. High-density zone 1

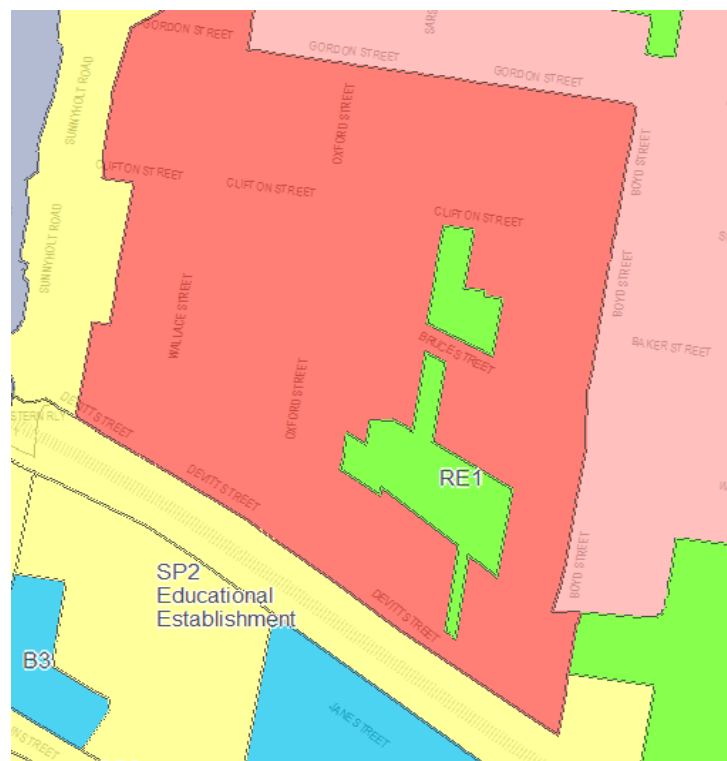


Figure 5. High-density zone 2

Socio demographic characteristics of participants are expected to vary across high- and low-density residences. In 2001, more than half of all people living in high-density residential areas were either living alone, or in a couple without children (Australian Bureau of Statistics, 2004). It is expected that the trends of increased living costs, and desire to live in areas with nearby services in Sydney, will draw larger families into high-density apartment style living (Australian Bureau Statistics, 2004).

3.6 Sample size

The survey was distributed by mail to all eligible households in the survey area, totalling 1089 households. High-density households (n=518) made up 47.56% of the surveys distributed, and low-density households (n=571) made up slightly more at 52.43% of the surveys distributed (Table 3). Participants were given the option to return a completed survey by post or complete the survey online. The online survey conducted through the Survey Monkey online survey platform included the same questions as the mail survey.

The density categorisation of survey distribution is detailed in Table 3.

Table 3.	
Dwelling numbers for survey distribution	
Zoned Area	Number of Dwellings
High-density	518
Low-density	571
Total	1089

3.7 Survey instrument development

The literature review identified a lack of a suitable existing survey instrument to gauge community perceptions and value of POS. A survey was developed by Ives et al. (2017) using mapping information technology in conjunction with questions regarding values of POS, which was distributed to a community in Lake Macquarie, NSW, Australia. This survey used categories to define qualities of POS using a Likert scale (Ives et al., 2017). The existing survey by Ives et al. (2017) was not considered suitable for my study in its entirety due to the large focus on geographical mapping systems for collection of data. Instead, a new survey was created for my study. The relevant categories used in the Ives et al. (2017) survey were adapted into my newly developed 'Public Open Space Survey 2017', in conjunction with input from Blacktown City Council to reflect the specific characteristics of POS in the selected residential areas for my study. The categories of value that were adapted from the survey created by Ives et al. (2017) included aesthetic/scenic, activity/physical exercise, native plants and animals, nature, cultural significance, health/therapeutic and social interaction.

The survey instrument used in my study was developed around the qualities utilised by Ives et al (2017) and also applied a five point Likert scale in many of the questions. The survey was distributed with a cover letter requesting the survey be completed by an adult on behalf of the rest of the household. This allowed data to be collected by a wider sample within the selected geographical area. The cover letter and survey can be found in Appendix 1: Consent Form and Questionnaire.

The newly developed Public Open Space Survey 2017 included three parts, with the first part including questions regarding the participant's values and current usage of POS. The second part was a visual question which was used to gain results about feelings towards actual locations within the Blacktown local government area. The third part requested socio-

demographic information of the participant and their household. A copy of the survey is provided in Appendix 1: Consent form and Questionnaire. Table 4 provides examples of the questions asked in the survey in each section.

Table 4.	
Example survey questions	
Survey section	Question
Values and usage of public open space	1. How important to you is public open space?
	4. How important are the following general qualities of public open space?
Visual question	13. Please look at the images below. Place a circle around the image that you like the best and put a cross through the image you like the least.
Socio-demographic information	15. How old are you?
	19. What type of home do you live in?
	20. How many people live in your home?

Questions were also included to collect self-reported health data such as height and weight, which was utilised to calculate body mass indexes (BMI) of participants. Participants were asked to rate their current health status. Whilst self-reported health data was collected, it is limited in its validity due to the subjective nature of responses by individuals who implicate their health status on a perceived scale that cannot be measured objectively (Kim et al., 2013). However, self-reported health data is a commonly collected form of data due to the large amount of resources required to collect clinical data on a large scale (Rosenman, Tennekoon, & Hill, 2011). The data were collected in order to explore a further comparison between POS value and use, and its relation to health. The link between POS and health has been thoroughly explored as demonstrated in the previous literature review. The relationship between POS and health is extremely varied, and collection of these data allowed the researcher to further understand the perceived value of POS and if this was related to health status.

At the time of survey creation, there were three questions that were of specific interest to Blacktown City Council but were not linked to a research question. For this reason, the data from these questions will not be analysed in this thesis, however, results for these questions can be found in Appendix 4: Data tables for survey questions not analysed.

These questions were:

- Question 5 – How important to you are the following general features of POS?
- Question 6 – How much would the following deter you from using public open space?
- Question 12 – How much would the following attract you to visit and use your closest public open space more often?

Socio demographic data and POS usage data were collected using open-ended short answer and multiple-choice questions. To determine the importance of POS characteristics and qualities, participants were asked to select the value of a series of general qualities and characteristics of POS using Likert scales.

Five point Likert scales ranging from ‘not at all important’ to ‘very important’ were used a number of times in the survey. This allowed specific qualities and characteristics that are of interest to the research to be clearly presented, and their value scaled according to the attitude of the participant (Likert, 1932). Responses from Likert scales are often disadvantaged by the perception of the participant. Alexandrov (2010) identified that not all participants assume there is equal distance between scale options and positive and negative responses are not perceived as complete opposites. This means that Likert scales are limited in their ability to measure the emotional strength of a response (Alexandrov, 2010). However, for the purpose of my research, the option of choosing from a fixed-response scale to determine the participants’ attitudes towards certain aspects of POS was considered as an

effective method of data collection, as the difference in perspective between participants could be gauged and easily compared using this method (Schneider, Whitehead, & Elliott, 2007).

A summary of the questions in the survey as well as their purpose in relation to answering the research questions can be found in Table 5.

Table 5.

Relationship between research questions and survey questions

Research Question	Survey Question	Relationship
1a. In high- and low-density communities, how important is POS to residents?	1. How important is POS to you?	Survey question directly answers research question when data analysed in high- and low-density groups of residents.
1b. In high- and low-density communities, what qualities of POS are most important to residents?	4. How important to you are the following general qualities of POS?	Survey question directly answers research question when data analysed in high- and low-density groups of residents.
1b. In high- and low-density communities, what qualities of POS are most important to residents?	13. Please look at the images below. Place a circle around the image that you like the best and put a cross through the image you like the least.	Each image represents a location within Blacktown City Council which has a clear quality, e.g. Sporting, picnic, natural space etc. Collecting this data indirectly supports the research question.
1b. In high- and low-density communities, what qualities of POS are most important to residents?	14. Please look at the images below and rate each one between 1 (poor) and 5 (excellent).	Each image represents a location within Blacktown City Council which has a clear quality, e.g. Sporting, picnic, natural space etc. Collecting this data indirectly supports the research question.
1c. In high- and low-density communities, what activities do residents undertake in POS?	11. When you visit this space, what do you do?	Survey question directly answers research question when data analysed in high- and low-density groups of residents.
1d. In high- and low-density communities, what is the level of use of POS and how does this vary?	7. In the last week, how many times did you visit POS?	Survey question directly answers research question when data analysed in high- and low-density groups of residents.
1d. In high- and low-density communities, what is the level of use of POS and how does this vary?	9. How often do you visit the POS closest to your residence?	Data collected used to support survey question 7 in directly answering research question when data analysed in high- and low-density groups of residents.

Table 5.

Relationship between research questions and survey questions

1d. In high- and low-density communities, what is the level of use of POS and how does this vary?	10. When you visit this space, how long do you usually stay?	Survey question directly answers research question when data analysed in high- and low-density groups of residents.
All of question 1	8. What is the name of the POS closest to your residence?	Data used to identify sample group as either high- or low-density living.
All of question 1	24. What is the nearest intersection to your home?	Data used to identify sample group as either high or low-density living.
2. What socio-demographic factors influence the qualities and activities undertaken in POS?	15. How old are you?	Socio-demographic data collection to use for comparison with data relating to qualities and activities undertaken in POS.
2. What socio-demographic factors influence the qualities and activities undertaken in POS?	16. Are you male/female?	Socio-demographic data collection to use for comparison with data relating to qualities and activities undertaken in POS.
2. What socio-demographic factors influence the qualities and activities undertaken in POS?	19. What type of home do you live in?	Socio-demographic data collection to use for comparison with data relating to qualities and activities undertaken in POS.
2. What socio-demographic factors influence the qualities and activities undertaken in POS?	20. How many people live in your home?	Socio-demographic data collection to use for comparison with data relating to qualities and activities undertaken in POS.
2. What socio-demographic factors influence the qualities and activities undertaken in POS?	21. How many people aged 17 and under live in your home?	Socio-demographic data collection to use for comparison with data relating to qualities and activities undertaken in POS.
2. What socio-demographic factors influence the qualities and activities undertaken in POS?	22. How long have you lived in your current home?	Socio-demographic data collection to use for comparison with data relating to qualities and activities undertaken in POS.
2. What socio-demographic factors influence the qualities and activities undertaken in POS?	23. What is your current employment status?	Socio-demographic data collection to use for comparison with data relating to qualities and activities undertaken in POS.
3. In all communities, does a high self-reported health status compared to a low self-reported health status impact on how the participant values and uses POS?	2. How important is health to you?	Survey question provides further detail to support the answer to the research question. Through understanding the importance of health, the impact of POS is valued.

Table 5.

Relationship between research questions and survey questions

3. In all communities, does a high self-reported health status compared to a low self-reported health status impact on how the participant values and uses POS?	3. In general, how would you rate your health?	Survey question gains self-reported health data from residents to directly answer research question.
3. In all communities, does a high self-reported health status compared to a low self-reported health status impact on how the participant values and uses POS?	17. What is your height?	Data collected to create BMI to review health status of resident.
3. In all communities, does a high self-reported health status compared to a low self-reported health status impact on how the participant values and uses POS?	18. What is your weight?	Data collected to create BMI to review health status of resident.
N/A	5. How important to you are the following general features of POS?	Question of interest to Blacktown City Council.
N/A	6. How much would the following deter you from using POS?	Question of interest to Blacktown City Council.
N/A	12. How much would the following attract you to visit and use your closest POS more often?	Question of interest to Blacktown City Council.

Note: POS = Public open space. N/A = Not applicable. BMI = Body mass index.

Upon completion of a draft of the survey, the survey was trialled and reviewed by a person external to the research team with expertise in the literacy levels of the Blacktown population. Based on feedback received from this survey respondent about the trial survey, changes were made to the wording and presentation of the survey to reduce the literacy level required to understand and respond to the survey. These changes were made to improve the face validity of the survey and encourage a higher response rate.

3.8 Data collection

Surveys have the ability to collect a large amount of data in a timely and cost effective manner. As the target population for this research was large and geographically dispersed, a survey was considered an appropriate data collection method (Dillman, Smyth, & Christian, 2014). A paper-based survey distributed by mail was required as a residential address was the only contact information available for the target population. An online response option was offered in the mailed survey to increase the ease of participation from the population and encourage a higher response rate.

Online surveys are often chosen as they are more time and cost effective for both the researcher and participant (Wright, 2005). In this context, the researcher was able to minimise cost by sending a reminder card directing participants to the online survey, rather than posting out additional copies of the paper-based survey when aiming to increase response rates. Considering these factors, The Public Open Space Survey 2017 was developed in conjunction with Blacktown City Council representatives as both a paper-based and online survey.

The survey was designed to be completed anonymously and was addressed to ‘the resident’ at each street address. Each mail out included a cover letter explaining the purpose and process of the survey, a consent form, a copy of the survey (Appendix 1: Consent form and Questionnaire) and a reply paid envelope. The mail-out began in August 2017 and responses were required by October 2017. A reminder card (See Appendix 2: Reminder card) was sent in the post in late September 2017 to all 1,089 eligible households to encourage responses by the due date. All returned forms included a signed consent form. Upon return of the survey, the signed consent form was detached from the survey responses by the researcher in order to de-identify data and retain confidentiality for the participant. The data collection process is summarised in Figure 8.

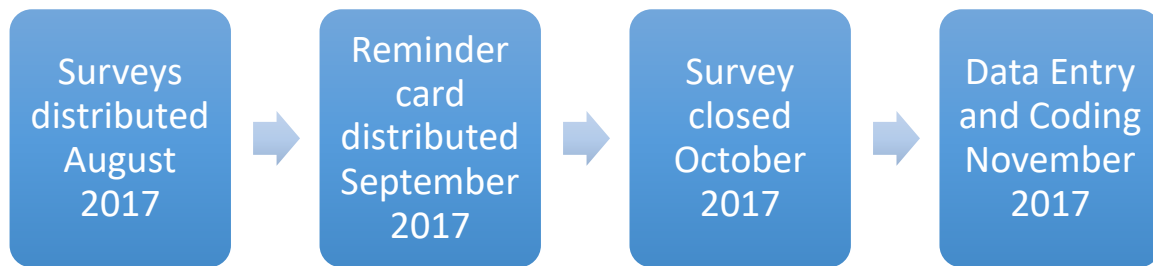


Figure 8. Data collection process.

A number of strategies were employed to encourage a higher response rate.

Participants had the opportunity to go into the draw to win one of two \$100 gift cards to a centralised shopping centre in Blacktown. The gift cards were funded by the researcher and were used to encourage participation due to the difficulty of blind recruitment (Polit & Beck, 2017). Monetary incentives are commonly used in situations where there is minimal risk to participants. As financial incentives can sometimes be interpreted as a coercion method, the researcher considered both the advantages and disadvantages of this method (Polit & Beck, 2017). Previous studies by Blacktown City Council using a mail-out method had as few as 3% response rates (A. Stafford, personal communication, August 20, 2018). Considering this, and the low risk to participants in my study, the advantages of offering an incentive were considered suitable.

To enable systematic analysis of the data, upon receipt of the surveys the researcher coded and collated the data into a Microsoft Excel document. Data were numerically coded to assist the importation of data into the program 'Statistical Package for the Social Sciences' (SPSS). This program is a software package that enables advanced data analysis (IBM, 2018) and is commonly used by researchers choosing a quantitative research approach. For example, each returned survey was given an identifying number. The responses to each

question were then given an identifying number, such as response Yes=1 or No=2 and numerically entered into a spreadsheet. Collating and coding the data in this numerical way then allowed easy integration into the SPSS software.

The data collected were stored and password protected on the researcher's personal computer. The surveys returned by mail were stored in the researcher's office in a locked filing cabinet. Upon coding into SPSS, the data were reviewed for accuracy through random selection of returned surveys which were checked for manual entry errors. A total of 16 surveys were reviewed for data entry errors (10.2% of all responses) and one error was found and rectified.

3.9 Exclusion criteria

Residents who did not live in designated residential areas selected as samples were ineligible to respond to the survey and were not provided with a survey. The residential area of participants was gauged through question 24 of the survey which asked participants to name the nearest intersection to their home. This intersection was cross-referenced with those included in the study areas. The valid study areas were identified in Figure 4,

Figure 5, Figure 6 and Figure 7. Any identified participant outside of these areas were excluded from data analysis.

All persons under 18-years-old were ineligible to participate in the survey, however data were captured through the adult participant answering questions on behalf of the household, including any children under the age of 18. Information about participant eligibility was communicated on the cover letter distributed with the survey (See Appendix 1: Consent form and Questionnaire).

3.10 Limitations

Participants may have been limited by their English literacy skills if their level of written English was below the Blacktown average upon which this survey was developed. This was minimised by the survey being analysed by an external person to the research team to ensure optimal readability for the Blacktown population.

Although geographical areas were zoned as R4, this did not mean that all dwellings in the area are high-density housing. For example, there may be standalone houses in amongst multiple storey apartments. However, the areas are considered high-density due to the number of dwellings within the selected geographical area (as discussed in the definitions section). The returned surveys were coded into a high-density or low-density group based on the identified nearest intersection. Any returned surveys that indicated their residence was a standalone house in a high-density area were coded into the high-density group due to this limitation.

3.11 Data analysis

Mailed survey responses were each given an identification number by the researcher and then coded to facilitate analysis in SPSS software. Coding involved allocating a numerical value to each potential response and then collating this data in an Excel spreadsheet. Online responses were directly exported from the Survey Monkey platform into an Excel spreadsheet. Mailed survey and online survey response data were then imported into SPSS for data analysis.

Descriptive statistics such as frequencies, means, medians and standard deviations were conducted on the complete data set that were comprised of Likert scale responses and socio-demographic information. These statistics provided an overview of the study population and the basic interest points of the study. At times, the data were analysed in high-

and low-density groups, which were identified by the participants nearest intersection, as detailed in the limitations section. Responses that did not provide enough information to be categorised into a high or low-density group were excluded from analysis where data were categorised as per their density. Data were presented using tables. Figures were produced using SPSS data in Microsoft Excel.

A number of new variables were created using the methods identified in Table 6. Of note is the creation of new variables for questions which were answered based on five point Likert scales. Each of these questions were recoded into two point responses to enhance data usage.

Table 6.

New variables created for data analysis

New Variable Name	Old variables used	Method of creation
Identified Density of Living	Q24. What is the nearest intersection to your home?	Suburb of intersection linked to low or high-density selected areas (Blacktown City Council Geographical Information System, 2017).
Body Mass Index	Q17. What is your height? Q18. What is your weight?	Used World Health Organisation Body Mass Index calculation and categorised data into underweight, normal weight, overweight and obese categories (World Health Organisation, 2018).
Recoded Likert scale responses	All variables with five point Likert scale responses ranging from	- 'Not at all important' and 'not very important' were recoded as 'not important' - Neutral responses were discarded

Table 6.

New variables created for data analysis

New Variable Name	Old variables used	Method of creation
	“not at all important” to “very important”.	- ‘Important’ and ‘very important’ were recoded as ‘important’
	Q1, Q2, Q4 and Q5.	

In order to answer the first research question, a statistical analysis was completed comparing high- density and low-density participants. Levels of significance were calculated using Open Epi website, comparing two rates at a 95% confidence interval (Dean, Sullivan, & Soe, 2006). In cases where response totals were greater than five, P exact tests were used. In cases where totals were less than five responses, Fisher’s exact tests were used.

3.12 Conclusion to the chapter

This chapter has outlined the underpinning methodology behind the research undertaken. An overview of the study design and the study setting of Blacktown, NSW. The selection of participants to form the study sample was detailed. The development of the survey instrument and the process of this development to specifically answer the research questions, was a large component of this research. After development of this survey, collection of the data were undertaken, and limitations of the study were identified. Finally, this chapter presented an overview of the data analysis process to ensure that each research question was answered.

Chapter 4: Results

4.1 Introduction to the chapter

Results in this chapter are presented in two sections. Firstly, demographic information of participants including age, gender, employment and housing status is provided. Secondly, quantitative responses to answer the research questions below are presented (See Table 7.

Table 7.

Research questions

Question 1	In high- and low-density communities: a. How important are POSs to residents? b. What qualities of POS are most important to residents? c. What activities do residents undertake in POS? d. What is the level of use of POS and how does this vary?
Question 2	What socio-demographic factors influence the qualities and activities undertaken in POS?
Question 3	In all communities, does a high self-reported health status compared to a low self-reported health status impact on how the participant values and uses POS?

Note: POS = Public Open Space.

4.2 Participants

Surveys were distributed to 1,089 households that were located in the study's setting. The number of surveys returned totalled 162 (n=162), representing a 14.8% response rate. Of these responses, 38 (23%) were received online and 124 (77%) were returned by post. Unopened returned questionnaires totalled 42 (4%) and were not included in this analysis. Table 8 displays the results categorised into high- and low-density responses.

Figure 9 presents a summary of the data collection process.

Table 8.

Number of survey responses

	High-density	Low-density	Total
Number of Dwellings Contacted	518	571	1089
Number of Responses	46	113	159*
Response Rate	9.0%	19.8%	14.8%

Note: * Three responses could not be categorised into high or low-density due to missing information.

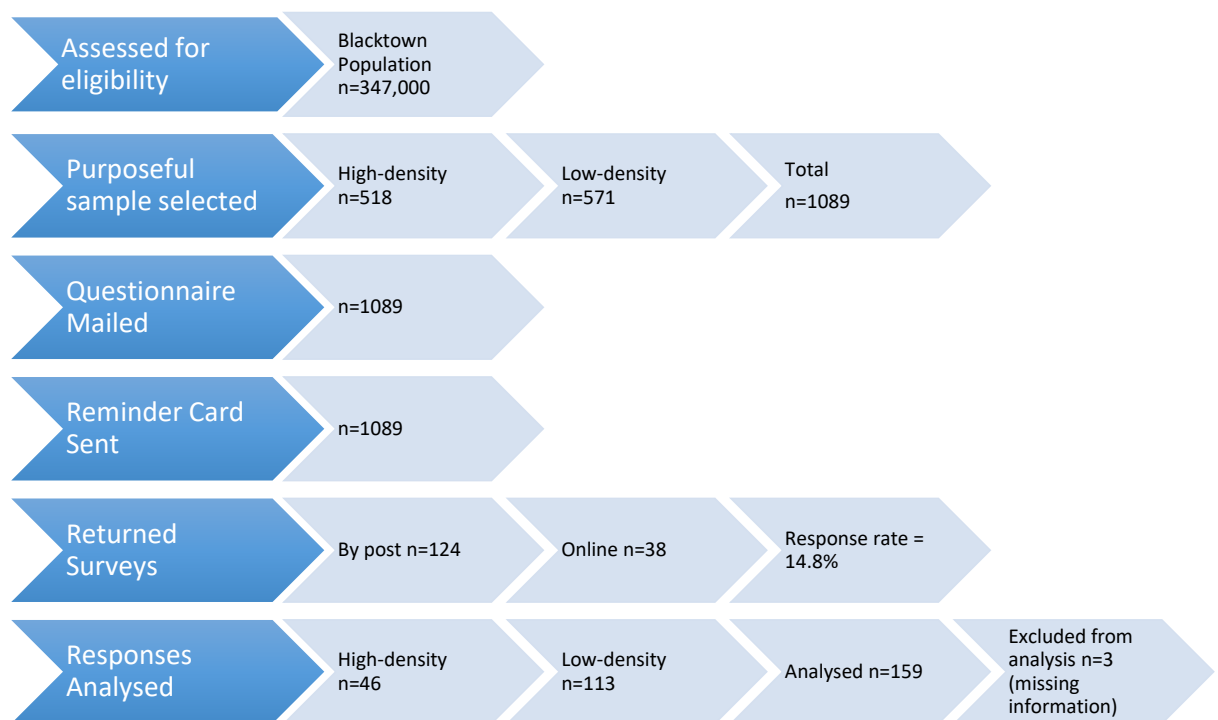


Figure 9. Data collection flow chart

4.3 Demographics of participants

Of the responses analysed, 93 (58.5%) were contributed by female participants and 66 (41.5%) were completed by male participants. Most responses (50 responses, 31.6%) received were completed by people in the 56 + age group. Following this, the 36-45 age group represented 42 (26.6%) responses received. The least amount of responses received were completed by people in the 18 to 25 year age group, representing only 5 (3.2%) responses received (Table 9).

Table 9.

Age and gender of participants

Age Category	Male	Female	Total
18-25	2 (3.1%)	3 (3.2%)	5 (3.2%)
26-35	14 (21.5%)	17 (18.3%)	31 (19.6%)
36-45	16 (24.6%)	26 (28.0%)	42 (26.6%)
46-55	13 (20.0%)	17 (18.3%)	30 (19.0%)
56+	20 (30.8%)	30 (32.3%)	50 (31.6%)
Total	65 (100%)	93 (100%)	158 (100%)

There was a mean of 3 people living in each dwelling, with responses ranging from 1 to 8 individuals living in each household. Of all dwellings, 97 (60.6%) had at least one child under the age of 18 years living in the home.

According to the survey responses received, 113 (71.1%) participants lived in houses, 32 (20.1%) in apartments and 13 (8.2%) in town houses. The average length of residency in the participant's current home was 12.5 years, with lengths ranging from two months to 60 years. The average length of residency for all participants was two years.

Table 10 identifies the employment status of participants. The majority of residents were either full time employed (n=58, 36.7%) or retired (n=43, 28.5%). There were no significant differences in this category between high- and low-density participants.

Table 10.

Employment status of participants

	Low-density (%)	High-density (%)	Total	p-value*
Retired	26 (23.4%)	17 (37.85)	43 (27.6%)	0.1331
Unemployed	8 (7.2%)	3 (6.7%)	11 (7.1%)	0.9466
Casual Employment	3 (2.7%)	4 (8.9%)	7 (4.5%)	0.2231
Part-time Employment	15 (13.5%)	2 (4.4%)	17 (10.9%)	0.1858
Full-time Employment	42 (37.8%)	16 (35.6%)	58 (37.2%)	0.8492
Self-employed	17 (15.3%)	3 (6.7%)	20 (12.8%)	0.2574
Total	111 (100%)	45 (100%)	156 (100%)	

Note: * P Exact tests were used to compare frequencies of responses. When cases totalled less than 5, Fishers exact test was used.

Overall, the demographic information about participants were not significantly different between high- and low-density residents. Results indicated a larger participation rate from older residents and females. There was no significant difference in employment status or BMI results between high- and low-density participants.

4.4 Participants' perceptions of the importance of public open space

To answer the first research question: "*In high- and low-density communities, how important are POSs to residents?*", participants were asked to rate the importance of POS (Table 11). To understand how residents valued POS, five point Likert scales were used throughout the questionnaire to explore the participants' perception about how they valued open space and the characteristics of open space that they felt were important. Participants

also rated their health status on a five point Likert scale from “poor” to “excellent”.

Responses were categorised into high- and low-density groups for the purpose of this analysis. All responses (n=152, 100%) indicated that the participants thought POS was either important or very important to them (Table 11).

Table 11.

Responses regarding value of public open space

	Low-density (%)	High-density (%)	Total	p-value*
How important to you is Public Open Space?				
Not important	0	0	0	>0.9999
Important	110 (100%)	42 (100%)	152 (100%)	0.9893
Total	110 (100%)	42 (100%)	152 (100%)	

Note: * P Exact tests were used to compare frequencies of responses. When cases totalled less than 5, Fisher’s exact test was used.

4.5 General qualities of public open space

To answer the research question: “*What qualities of POS are most important to residents?*”, participants were presented with a list of general qualities of POS which they were asked to rate in importance. These included nature (plants and animals), opportunity for physical activity, opportunity for social interaction, health/therapeutic benefits, aesthetics and cultural significance of the POS (Table 12).

Qualities of POS are general benefits that are often associated with green space. These are not generally fixed infrastructure, but rather the benefits that may result from the infrastructure. Nature was considered the most important quality regardless of high- or low-density of living, with 100% (n=149) of all low and high-density residents indicating that it was important. Of least importance was cultural significance of POS with 30.3% (n=23) of

low-density living and 20% (n=7) of high-density living residents indicating it was not important in POS. Opportunity for physical activity and aesthetically pleasing/scenic also rated highly amongst both high- and low-density participants. Results from all participants, using a five point Likert scale are provided in Appendix 5: Five Point Likert Scale Responses.

Table 12.

Responses regarding importance of general qualities of public open space

	Low-density (%)	High-density (%)	Total (%)	p-value*
Nature (plants and animals)				
Not important	0	0	0	>0.9999
Important	109 (100%)	40 (100%)	149 (100%)	0.9887
Total	109 (100%)	40 (100%)	149 (100%)	
Opportunity for physical activity				
Not important	0	2 (4.9%)	2 (1.4%)	0.1599
Important	104 (100%)	39 (95.1%)	143 (98.6%)	0.8005
Total	104 (100%)	41 (100%)	145 (100%)	
Opportunity for social interaction				
Not important	2 (2.1%)	2 (5.6%)	4 (3.0%)	0.6012
Important	94 (97.9%)	34 (94.4%)	128 (97.0%)	0.8690
Total	96 (100%)	36 (100%)	132 (100%)	
Health/therapeutic benefits				
Not important	2 (2.2%)	4 (9.8%)	6 (4.5%)	0.1506
Important	91 (97.8%)	37 (95.5%)	128 (95.5%)	0.6871
Total	93 (100%)	41 (100%)	134 (100%)	
Aesthetically pleasing/scenic				
Not important	1 (1.0%)	1 (2.5%)	2 (1.4%)	0.9512
Important	104 (99.0%)	39 (97.5%)	143 (98.6%)	0.9444
Total	105 (100%)	40 (100%)	145 (100%)	
Cultural Significance				
Not important	23 (30.3%)	7 (20.0%)	30 (27.0%)	0.3441
Important	53 (69.7%)	28 (80.0%)	81 (73.0%)	0.5531
Total	76 (100%)	35 (100%)	111 (100%)	

Note: * P Exact tests were used to compare frequencies of responses. When cases totalled less than 5, Fisher's exact test was used.

In addition, to assist answering this question, residents were also presented with a selection of images which represented a number of the previously mentioned qualities related to POS. These images included a fitness station, sportsground, picnic table, natural area, landscaped garden and a cultural area. Participants were asked to select the image they liked best, along with the image they liked least. There was a notable difference in response between high- and low-density residents for the image related to cultural areas. Almost half (n=18; 47.4%) of participants in high-density living did not like this image (Table 13). The image liked the best by both high- and low-density participants was the landscaped garden. The number of participants who selected the cultural area as the image they liked least (n=38; 28.1%) is consistent with results from question four, where participants were asked to rate the importance of cultural significance. In this question, 27% of the population (n=30) indicated that cultural significance was not important.

Table 13.

Responses to imagery based question

	Low-density (%)	High-density (%)	Total	p-value*
Image liked best				
Fitness station	9 (9.2%)	3 (7.1%)	12 (8.6%)	0.9850
Sportsground	2 (2.0%)	1 (2.4%)	3 (2.1%)	>0.9999
Picnic table	28 (28.6%)	11 (26.2%)	39 (27.9%)	0.8266
Natural area	18 (18.4%)	2 (4.8%)	20 (14.3%)	0.07097
Landscaped garden	39 (39.8%)	23 (54.8%)	62 (44.3%)	0.2296
Cultural area	2 (2.0%)	2 (4.8%)	4 (2.9%)	0.6966
Total	98 (100%)	42 (100%)	140 (100%)	
Image liked least				
Fitness station	13 (13.4%)	5 (13.2%)	18 (13.3%)	0.9985
Sportsground	40 (41.2%)	11 (28.9%)	57 (37.8%)	0.3088

Table 13.

Responses to imagery based question

	Low-density (%)	High-density (%)	Total	p-value*
Picnic table	7 (7.2%)	1 (2.6%)	(5.9%)	0.5874
Natural area	15 (15.5%)	3 (7.9%)	18 (13.3%)	0.4200
Landscaped garden	2 (2.1%)	0	2 (1.5%)	>0.9999
Cultural area	20 (20.6%)	18 (47.4%)	38 (28.1%)	0.01266
Total	97 (100%)	38 (100%)	135 (100%)	

Note: * P Exact tests were used to compare frequencies of responses. When cases totalled less than 5, Fishers exact test was used.

Results from participants who had children living in their home indicated that they were more likely to use nearby POS compared to those with no children living at home. Participants were asked to identify how many people aged 17 years and under resided in the home. Whilst reviewing survey responses it was noted that of those 21 people who identified that they never used their local POS, 57.1% (n=12) had no children living in their home under 17 years of age (Table 14.

Table 14.

Participants level of visitation to POS closest to the home

Number of people aged 17 and under living in the home	Never	Once a month	Once every two weeks	Once a week	More than once a week	Total
0	12 (19.7%)	10 (16.4%)	5 (8.2%)	18 (29.5.0%)	16 (26.2%)	61 (100%)
1	5 (10.6%)	7 (14.9%)	6 (12.8%)	12 (25.5%)	17 (36.2%)	47 (100%)
2	3 (12.5%)	3 (12.5%)	3 (12.5%)	7 (29.2%)	8 (33.3%)	24 (100%)
3	1 (5.3%)	6 (31.6%)	2 (10.5%)	1 (5.3%)	9 (47.4%)	19 (100%)
4	0	2 (33.3%)	0	2 (33.3%)	2 (33.3%)	6 (100%)
Total	21	28	16	40	52	157

Table 15.

Number of children living in the home			
	Participants who do not use POS	Participants who use POS	Total
No children in the home	12 (19.7%)	49 (80.3%)	61 (100%)
At least one child in the home	9 (9.4%)	87 (90.6%)	96 (100%)

Note: POS = Public Open Space

4.6 General features of public open space

Participants were presented with a list of features of POS which they were asked to rate in importance. These included car parking, dog-off-leash area, fitness equipment, landscaping, opportunity for playing sport, outdoor courts, picnic areas, playground, seating, skate park, amenities and walking paths (Table 16). Features of POS include physical infrastructure within the space that support activities. The strongest response was towards the importance of landscaping (trees, gardens) with 99.1% of low-density (n=105) and 100% of high-density (n=43) residents indicating it was important. Skate parks were indicated as the least important feature with 59% of low-density (n=46) and 45.5% of high-density (n=15) residents indicating it was not important. Results from all participants, using a five point Likert scale, are provided in Appendix 5: Five Point Likert Scale Responses.

Table 16.

How important are general features of public open space?

	Low-density (%)	High-density (%)	Total (%)	p-value*
Car Parking				
Not Important	4 (4.0%)	3 (7.7%)	7 (5.0%)	0.6098
Important	97 (96.0%)	36 (92.3%)	133 (95.0%)	0.8505
Total	101 (100%)	39 (100%)	140 (100%)	
Dog off leash area				
Not Important	30 (39.5%)	19 (55.9%)	49 (44.5%)	0.2412
Important	46 (60.5%)	15 (44.1%)	61 (55.5%)	0.2889
Total	76 (100%)	34 (100%)	110 (100%)	
Fitness Equipment				
Not Important	15 (19.2%)	7 (21.9%)	22 (20.0%)	0.6593
Important	63 (80.8%)	25 (78.1%)	88 (80.0%)	0.9014
Total	78 (100%)	32 (100%)	110 (100%)	
Landscaping (trees, gardens)				
Not Important	1 (0.9%)	0	1 (1.0%)	>0.9999
Important	105 (99.1%)	43 (100%)	148 (99.0%)	0.9484
Total	106 (100%)	43 (100%)	149 (100%)	
Open green space to play sport				
Not Important	0	2 (5.0%)	2 (1.0%)	0.1565
Important	103 (100%)	38 (95.0%)	141 (99.0%)	0.7978
Total	103 (100%)	40 (100%)	143 (100%)	
Outdoor Courts				
Not Important	13 (14.9%)	4 (12.9%)	17 (14.4%)	>0.9999
Important	74 (85.1%)	27 (87.1%)	101 (85.6%)	0.9029
Total	87 (100%)	31 (100%)	118 (100%)	
Picnic Area				
Not Important	2 (1.9%)	2 (4.8%)	4 (2.7%)	0.6464

Table 16.

How important are general features of public open space?

	Low-density (%)	High-density (%)	Total (%)	p-value*
Important	103 (98.1%)	40 (95.2%)	143 (97.3%)	0.8846
Total	105 (100%)	42 (100%)	147 (100%)	
Playground				
Not Important	2 (2.0%)	3 (7.9%)	5 (3.6%)	0.2689
Important	97 (98.0%)	35 (92.1%)	132 (96.4%)	0.7649
Total	99 (100%)	38 (100%)	137 (100%)	
Seating				
Not Important	1 (1.0%)	1 (2.4%)	2 (1.4%)	0.9796
Important	104 (99.0%)	41 (97.6%)	145 (98.6%)	0.9478
Total	105 (100%)	42 (100%)	147 (100%)	
Skate Park				
Not Important	46 (59.0%)	15 (45.5%)	61 (55.0%)	0.3870
Important	32 (41.0%)	18 (54.5%)	50 (45.0%)	0.3367
Total	78 (100%)	33 (100%)	111 (100%)	
Toilets/amenities				
Not Important	3 (2.8%)	1 (2.5%)	4 (2.7%)	>0.9999
Important	103 (97.2%)	39 (97.5%)	142 (97.3%)	0.9745
Total	106 (100%)	40 (100%)	146 (100%)	
Walking Paths				
Not Important	1 (0.9%)	1 (2.3%)	2 (1.3%)	0.9769
Important	107 (99.1%)	42 (97.7%)	149 (98.7%)	0.9482
Total	108 (100%)	43 (100%)	151 (100%)	

Note: * P Exact tests were used to compare frequencies of responses. When cases totalled less than 5, Fisher's exact test was used.

4.7 Activities undertaken in public open space

To answer the question: “*What activities do residents undertake in POS?*”, residents were asked to select all activities they participate in when they visit POS. These included walking, playing with children, sitting or relaxing, observing nature, socialising with others, doing physical exercise or fitness activities, exercising the dog, organised sporting activities. Residents were also asked to indicate whether they did not visit the POS. The most common activity undertaken by both low and high-density participants was walking (n=103; 67.8%), followed by playing with children (n=91, 59.9%), then sitting/relaxing (n=79; 52.0%) (Table 17). Exercising the dog was more popular with low-density residents (n=33; 30.8%) than high-density residents (n=4; 8.9%). Residents who exercised their dog reported visiting their local POS more often than the whole population, with 29.7% indicating that they visited POS 4+ times per week compared to 18.6% of the survey population who visited 4+ times per week.

Table 17.

When you visit this space, what do you do?

	Low (n=107)	High (n=46)	Total (n=153)	p-value
Walk	70 (65.4%)	33 (73.3%)	103 (67.8%)	0.6560
Play with my children	61 (57%)	30 (66.7%)	91 (59.9%)	0.5425
Sit/relax	52 (48.6%)	27 (60%)	79 (52.0%)	0.4255
Observe nature	42 (39.3%)	26 (57.8%)	68 (44.7%)	0.1497
Socialise with others	42 (39.3%)	16 (35.6%)	58 (38.2%)	0.6955
Physical exercise/ fitness activities	39 (36.4%)	18 (40%)	57 (37.5%)	0.7919
Exercise the dog	33 (30.8%)	4 (8.9%)	37 (24.3%)	0.01081
Organised sport	9 (8.4%)	7 (15.6%)	16 (10.5%)	0.2521
I do not visit this space	11 (10.3%)	3 (6.7%)	14 (9.2%)	0.5127

Note: * P Exact tests were used to compare frequencies of responses. When cases totalled less than 5, Fishers exact test was used.

4.8 Usage levels of public open space

To answer the question: “*What is the level of use of POS and how does this vary?*”, residents were asked how often they visited POS in the last week. Both high- and low-density populations were similar; they averaged 2 visits to POS in the last week (see Table 18). However, when asked in question eight to name the closest POS to their residence, 12.3% (n=20) of all participants could not name their closest POS. Residents were also asked how often they visited the POS closest to their residence (Table 18). According to their survey responses, on average, participants visited POS ‘once a week’, however, the mode was ‘more than once a week’.

The data gathered that answered the research question relating to length of time spent in open space suggest that, on average, participants spent 30 minutes to one hour when they visit their local POS (Table 18). There was a difference between the amount of time low and high-density participants spent at their local POS. Low-density participants were more likely to visit for shorter periods of less than 30 minutes or 30 minutes to 1 hour compared to high-density participants who were more likely to spend 1 - 2 hours visiting.

Table 18.

Responses regarding visiting public open space

	Low-density (%)	High-density (%)	Total (%)	p-value*
In the last week, how many times did you visit public open space?				
0	16 (14.5%)	8 (17.4%)	24 (15.4%)	0.6699
1	17 (15.5%)	7 (15.2%)	24 (15.4%)	0.9964
2	35 (31.8%)	13 (28.3%)	48 (30.8%)	0.7326
3	20 (18.2%)	11 (23.0%)	31 (19.9%)	0.4652
4+	22 (20.0%)	7 (15.2%)	29 (18.6%)	0.5477
Total	110 (100%)	46 (100%)	156 (100%)	
How often do you visit the public open space closest to your residence?				
Never	16 (14.4%)	5 (10.9%)	21 (13.4%)	0.6077
Once a month	21 (18.9%)	8 (17.4%)	29 (18.5%)	0.8634
Once every two weeks	15 (13.5%)	1 (2.2%)	16 (10.2%)	0.05948
Once a week	24 (21.6%)	16 (34.8%)	40 (25.5%)	0.1486
More than once a week	35 (31.5%)	16 (34.8%)	51 (32.5%)	0.7342
Total	111 (100%)	46 (100%)	157 (100%)	
When you visit this space, how long do you usually stay?				
I never visit	13 (11.7%)	4 (8.9%)	17 (10.9%)	0.6616
Less than 30 minutes	28 (25.2%)	4 (8.9%)	32 (20.5%)	0.03398
30 minutes – 1 hour	47 (42.3%)	17 (37.8%)	64 (41.0%)	0.7018
1-2 hours	21 (18.9%)	14 (31.1%)	35 (22.4%)	0.1580
More than 2 hours	2 (1.8%)	6 (13.3%)	8 (5.1%)	0.01832
Total	111 (100%)	45 (100%)	156 (100%)	

Note: * P Exact tests were used to compare frequencies of responses. When cases totalled less than 5, Fishers exact test was used.

The difference in time spent at POS between high- and low-density participants is demonstrated in Figure 10. Low-density participants were more likely to spend less time in POS than high-density participants. High-density participants stayed for longer periods of time overall, in comparison to low-density participants.

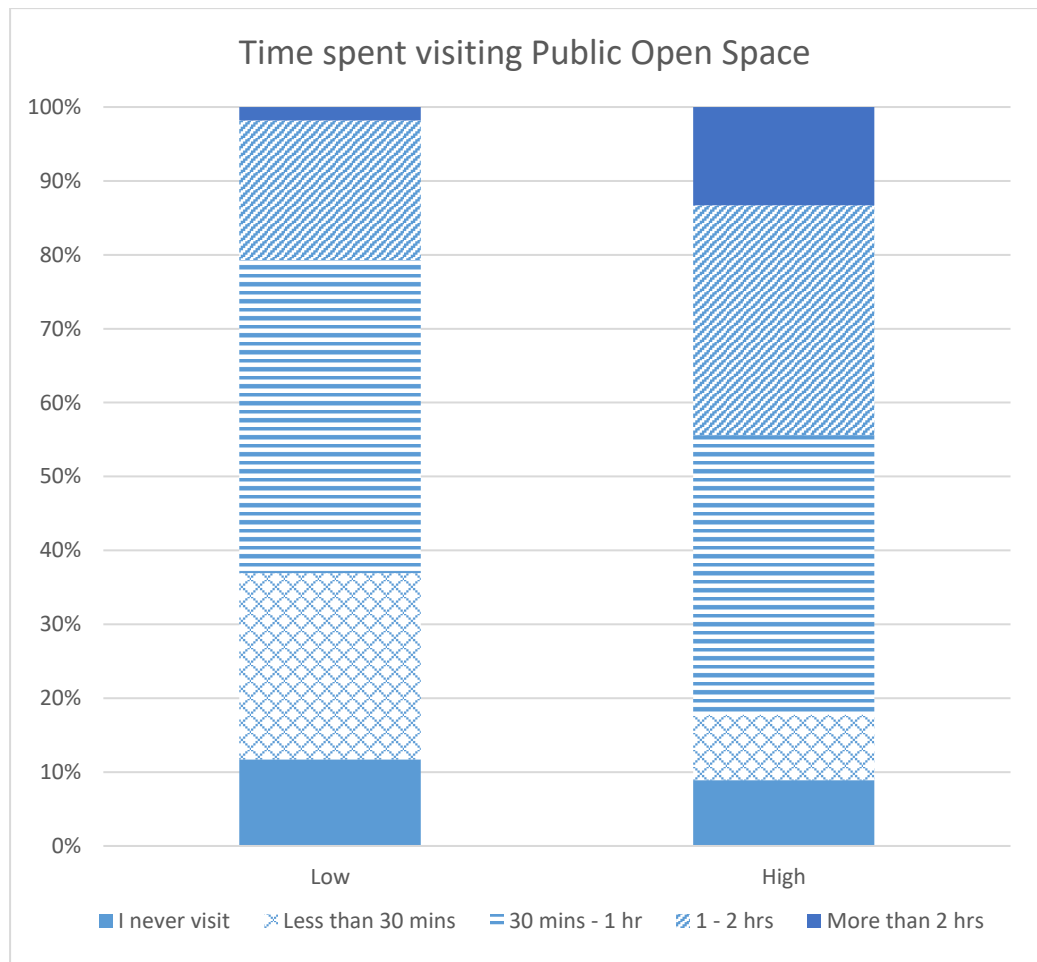


Figure 10. Reported time spent visiting public open space.

When comparing BMI results to the length of time participants usually spend at their POS, Table 19 shows a relationship between mean BMI and time spent visiting POS, apart from those who spend over two hours visiting.

Table 19.

BMI comparison to length of time spent visiting public open space

	N	Minimum BMI	Maximum BMI	Mean BMI	Std. Deviation
I never visit	13	18.4	56.4	28.368	11.0395
Less than 30 minutes	29	19.5	47.5	27.100	6.0032
30 minutes – 1 hour	53	19.5	47.5	26.439	4.5652
1-2 hours	29	18.8	41.3	25.885	4.6771
More than 2 hours	8	18.7	62.0	31.000	13.2171

Note: * There were a number of participants that did not provide sufficient information to calculate BMI results. BMI = Body Mass Index.

4.9 Self-reported health status

Participants rated the importance they placed on health (Table 20. Health was identified as being important to almost all participants (n=156; 99.4% of participants). Only one response indicated that health was not important. Further to this, participants were also asked to rate their own health status (Table 20. The majority of residents rated their health positively, as either “good” (n=50, 31.3%), “very good” (n = 57; 35.6%) or “excellent” (n =40; 25%). Minimal responses indicated a “poor” (n=2; 1.3%) or “fair” (n=11; 6.9%) health status. There were no considerable differences in self-reported health status identified between high- and low-density populations.

Table 20.

Responses related to health status

	Low-density (%)	High-density (%)	Total	p-value*
How important is health to you?				
Not important	0	1 (2.2%)	1 (0.6%)	0.2866
Important	112 (100%)	44 (97.8%)	156 (99.4%)	0.9097
Total	112 (100%)	45 (100%)	157 (100%)	
In general, how would you rate your health?				
Poor	1 (0.9%)	1 (2.2%)	2 (1.3%)	0.9847
Fair	7 (6.1%)	4 (8.7%)	11 (6.9%)	0.7876
Good	35 (30.7%)	15 (32.6%)	50 (31.3%)	0.8311
Very Good	44 (38.6%)	13 (28.3%)	57 (35.6%)	0.3268
Excellent	27 (23.7%)	13 (28.3%)	40 (25.0%)	0.5940
Total	114 (100%)	46 (100%)	160 (100%)	

Table 21. presents data from 133 participants who provided both height and weight to calculate BMI results. BMI is often used to gain perspective on the health of a population by ranking their potential body fat on a scale. BMI was similar between high- and low-density participants, with a mean of 26.88. A wide range of results were calculated, ranging from 18.40 to 62.00. Two outliers were identified in the data, with a BMI of 56.4 in the low-density group and 62.00 in the high-density group. Excluding these two outliers resulted in a population mean of 26.40 and standard deviation of 5.16. As the outliers did not have a large impact on the results, they were not included in the analysis.

Table 21.

Calculated Body Mass Index

	Low-density	High-density	Total population
N	96	39	135
Minimum	18.70	18.40	18.40
Maximum	56.40	62.00	62.00
Mean	26.97	26.68	26.88
Standard Deviation	6.2082	7.2586	6.5025
p-value (t-test)			0.8153

Table 22 presents BMI data as related to the World Health Organisation (WHO) BMI categories related to health (World Health Organisation, 2018). The majority of responses (n=59, 44.4%) fell into the normal BMI range. There was no significant difference between the responses of high- and low-density participants.

Table 22.

Calculated Body Mass Index in World Health Organisation Categories

	Low-density	High-density	Total population	p value*
Underweight	0	1 (2.6%)	1 (0.8%)	0.5714
Normal	39 (41.1%)	20 (52.6%)	59 (44.4%)	0.3678
Overweight	35 (36.8%)	12 (31.6%)	47 (35.3%)	0.6623
Obese	21 (22.1%)	5 (13.2%)	26 (19.5%)	0.3014
Total	95 (100%)	38 (100%)	133 (100%)	

Note: * P Exact tests were used to compare frequencies of responses. When cases totalled less than 5, Fisher's exact test was used.

4.10 Conclusion to the chapter

No significant differences were not found in the demographic data between respondents from high- and low-density settings. More results were received from older residents aged 56 and over compared to those younger; there were also more responses from female residents. There was no significant difference in employment status or BMI results between the responses received from residents in high- and low-density areas.

Results indicated that almost all of the residents valued POS. Likert scale results indicated that the residents who responded to the survey valued nature as the most important general quality of POS. Landscaping (trees, gardens) was also important to both high- and low-density residents, with almost all responses indicating it was important. Of least importance was cultural significance for both high- and low-density residents. Cultural significance was represented again in an imagery-based question, of which almost half of high-density residents selected a cultural area as an image they liked least.

The most popular activity to undertake in POS was walking, followed by playing with children and sitting/relaxing. Participants who had children living in their home were more likely to use nearby POS compared to participants with no children living at home.

The level of use of POS was varied between high- and low-density participants. Whilst regularity of visitation was similar, length of time spent visiting was different between high- and low-density participants. High-density participants were more likely to visit their nearby POS for periods of 1 to 2 hours. Low-density residents indicated they spend shorter periods of less than 30 minutes or 30 minutes to one hour at their local POS.

The majority of responses received rate their own health status as either good or very good. There were no considerable differences between high- and low-density population in their self-reported health status, or their calculated BMI results. This, and other major findings and their implications will be further explored and discussed in the next chapter.

Chapter 5: Discussion

5.1 Introduction to the chapter

In this chapter, the key findings from the research are discussed in association with previously reported research. These findings are considered in relation to the wider context of POS planning and the impact on health for communities. The aim of the study was to determine whether or not high- and low-density communities value and use POS differently, and desire different qualities in POS in Blacktown, NSW, Australia. The discussion of these findings is divided into sections which are related to the research questions (Section 1.5). The first section discussed in this chapter is the role of open space, the second is how socio-demographic data and open space usage are related. The third section covers the findings from the health data collected, followed by the methodological contribution of the study and further implications for research and policy. To conclude, limitations of the study are discussed.

5.2 Value and use of public open space

The first research question posed in my study asked high- and low-density communities:

- a. How important is public open space to residents?
- b. What qualities of public open space are most important to residents?
- c. What activities do residents undertake in public open space?
- d. What is the level of use of public open space and how does this vary?

A key finding in the results that answered this research question was that although there was no difference in the importance placed on POS by participants, there was a clear difference in the way that POS was used between high- and low-density residents. High-density participants indicated that when they visited their local POS, they stayed for a longer

period of time than their low-density counterparts. The difference in time spent in POS could be attributed to the differences in living spaces between high- and low-density residents. High-density forms of living, such as apartment and town-house living, have restrictions on access to private open space, such as backyards or gardens. Coolen and Meesters (2012) explored the differences between public and private open space and the value of these types of spaces to residents in the Netherlands. They found that governments were seeking to develop a compact city approach and subsidise the lack of private open space with larger quantities of POS and raised the question as to whether this approach is a suitable substitute (Coolen & Meesters, 2012). They also found that private open space, such as backyards and gardens were used as an additional living space to the dwelling for peace and liveability, whereas POS was used to connect with nature and improve the liveability of the neighbourhood (Coolen & Meesters, 2012). The findings of my study provide substance for this concept, as high-density residents in my study spent more time in POS in comparison to their low-density counterparts, which could be attributed to the smaller average dwelling size in high-density developments.

With consideration of the need for additional living space for those living in high-density dwellings, the expansion of the home into open spaces is also identified in a recent international study conducted by Husqvarna (2016). The study questioned landscape architectural students spanning 15 countries across North America, Europe, Asia, South America and Australia about the future of urban parks. Husqvarna (2016) identified that parks will “serve as the new recreation room” (p.6) due to the reduction of living space within the home. Parks were proposed to be a new “garden, playroom, living room or home workshop” (p. 6). The concept of parks being additional rooms for residents to use supports the idea of POS becoming an extension of the home and could also explain the extended amount of time people in high-density living are spending in POS according to my study. It

should therefore be asked whether the provision levels of POS should change depending on the level of density, for the reasons identified by Coolen and Meesters (2012) in their study.

Whilst the length of time for visitation was different between high- and low-density populations, there was a similar frequency of visitation between the two population groups. My study has identified that residents value the presence of POS extremely highly, and report spending more time utilising it if they are living in high-density areas. The extended use of POS by high-density residents emphasises the importance of considering a higher provision level of POS depending upon level of housing density. As Sydney is expected to double its population within the next 40 years (The Committee for Sydney, 2016), local governments across the city are expected to increase the supply of housing in order to meet this demand. The need for POS will be compounded.

The findings of my study have indicated that high-density residents report, on average, spending more than one hour in their local POS. From an urban planning perspective, it is important to consider places for residents to sit and relax, along with the range of activities that POS is used for within these communities. In a study conducted by Chen, Liu, Xie, and Golicnik Marusic (2016) in the Chinese community of Shenzhen, researchers used multi regression analysis to explore the relationship between POS characteristics and utilisation statistics. It was found that characteristics such as large lawn spaces, footpaths, seating, commercial facilities such as cafes or shops and water precincts, attracted more time spent in each POS location. Elements that did not affect this utilisation were landscape elements such as vegetation and sculptures (Chen et al., 2016). POS is often considered an extension of the home, as well as a place to enjoy nature, relax, exercise, play, socialise and interact with others. It is important to consider additional infrastructure that encourages residents to stay in the space due to the large amount of activities that were popular with both high- and low-density residents in my study. Supporting infrastructure

should be considered as areas of focus or consideration for urban planners for settings similar to those of my study.

When provided with a list of common activities undertaken in POS, participants in my study living in high-density areas selected more activities from this list in comparison to their low-density counterparts. In almost every activity category, a larger percentage of residents living in high-density areas indicated they participate in the proposed activity. The exception to this was the activity of exercising the dog, which was more popular for low-density residents. My study did not collect information regarding the number of participants who owned dogs. The high number of low-density residents exercising their dogs could be related to residents living in low-density being more likely to own dogs due to the availability of space in the dwelling, as well as available private open space. These findings support those of the Australian Bureau Statistics (2004) who found in their most recent data related to dog ownership collected, that people living in detached housing were more likely to own a dog than those in apartments or townhouses (Australian Bureau Statistics, 2004).

Further to this, participants who exercised their dogs were reported to visit their local POS more often than the average population. My finding is similar to that of Veitch, Christian, Carver, and Salmon (2019) who conducted a study in Melbourne, Australia using self-reported survey data related to the frequency and duration of POS visitation of dog owners compared to residents visiting POS without a dog. Veitch et al. (2019) found that both adults and children who visit POS with a dog visit more often than those who do not visit with a dog. Dog owners have been identified to have a higher physical activity level due to the maintenance and exercising responsibilities of ownership, compared to non-owners (Christian et al., 2017; Lim & Rhodes, 2016). It is recommended that POS should be designed to encourage dog owners to continue to use the space, and include elements such as access to water and shade to facilitate higher usage (Veitch et al., 2019).

Patterns of activity relating to usage of POS can be highly influenced by POS characteristics such as “location, size and form, relationship to buildings and provision of facilities in outdoor space” (Zhang & Lawson, 2009) . Although the locations selected in my study were similar in their characteristics there could be other factors that influenced the time spent in POS by the residents surveyed. The activity patterns of local residents should be considered when planning high-density development to ensure that the space is designed to attract the highest level of use.

The insufficient provision of POS can have an undesirable impact on the health of a community (World Health Organisation, 2019). The importance of planning and its impact on health, is identified through the finding of a relationship between BMI and time spent visiting POS across the research population in my study. Although not statistically significant, as the reported length of time in POS increased, so too did participants BMI. This link between BMI and time spent visiting POS reflects the numerous studies which relate the positive impact of POS to BMI and health through increased physical activity (Astell-Burt et al., 2014; Sanders et al., 2015). Sanders et al. (2015) analysed data collected as part of the Longitudinal Study of Australian Children which collected BMI data every two years from 4,423 children aged 6 - 7 years old in the initial data collection. Sanders et al. (2015) found that in an Australian environment, the positive impact from POS on BMI was stronger as children got older. However, the researchers suggest that further exploration is needed to fully understand the relationship between age and POS benefit.

Planning and health literature indicates that the provision of POS can have an impact on health, specifically relating to the decrease in chronic diseases. The findings from my study and previous studies (Zhang & Lawson, 2009) suggest that the provision of POS has the ability to change people’s patterns of behaviour, and reduce common barriers, such a cost and accessibility, to participation in physical activity. As the rates of chronic disease in

Australia increase, the provision of well-planned and designed POS can be considered a solution that has the potential to positively affect the wider population, regardless of socio-demographic background or circumstance (Sugiyama, Carver, Koohsari, & Veitch, 2018).

The most popular activity selected by participants in my study was walking. In a high-density environment, physical activity often occurs through access to POS as well as active transport options. The Australian Heart Foundation encourages high-density developments that are designed to improve walkability for its residents. It is important to consider that the traditional suburban sprawl of a number of Australian cities can be linked to reduced walking and increased sedentary behaviours. The Australian Heart Foundation has taken a position of encouraging well-planned high-density cities, with the required supporting infrastructure to encourage residents to walk for transport (Udell et al., 2014). The basis for this support from The Australian Heart Foundation is due to the positive effects of physical activity on coronary-related chronic disease. Walking is also an activity that can be engaged in by most people regardless of demographic or social factors. It can be enjoyed by a large percentage of the population as demonstrated in my study. The popularity of walking in my study displays the need to provide POS which attracts people to walk, including linking routes to encourage walking for transport, and creating places with supporting infrastructure such as water, toilets and seats to encourage activity.

A common desire within the urban planning industry is to create a *walkable city* (Speck, 2018). This term refers to a number of elements which collaboratively support and encourage the practice of walking for both recreation and active transport. Speck (2018) presents ten elements that make a city walkable. These elements involved limiting opportunities in the city for parking, the utilisation and accessibility of public transport, the encouragement of public green space and associated infrastructure such as seating and shade, and ensuring that all elements are designed to make pedestrians feel comfortable in their

environment (Speck, 2018). Each of these elements can be implemented regardless of the housing density of the area and should be taken into consideration when planning any new development to encourage walking as both a form of recreation and active transport.

Responses from residents living in both high- and low-density areas indicated that the most important qualities of POS in my study regardless of density, were nature and aesthetics. These findings are consistent with the findings of Ives et al. (2017) who found that community values in the lower hunter region of NSW also presented cultural significance as the lowest rated value, and aesthetics/scenic as the highest. Jim and Chen (2006) also found that residents highly valued nature due to the understanding of the importance it plays in the ecosystem, and provides places for recreation, aesthetic enhancement and screening undesirable views. When conducting a review of their high-density living provision, the findings of the Gold Coast City Council, Queensland, Australia, relating to sport and recreation are also consistent. Within the Gold Coast area, it was found that POS is often valued by residents as a natural environment as well as the benefit it provides for natural views from residential areas (MAK Planning and Design et al., 2015). This finding could also be representative of the community understanding of the beneficial health impact that contact with nature can provide a community.

Ekkel and de Vries (2017) note that the presence of natural spaces has the ability to improve cardiovascular health, mental health and, of most relevance, self-reported general health status. The findings in my study, regarding the importance of nature and the aesthetics of POS simply reflect the already abundant amount of research completed regarding the value of nature to the surrounding community (Astell-Burt et al., 2013; Bertram & Rehdanz, 2015; Byrne & Sipe, 2010; Cyril, Oldroyd, & Renzaho, 2013). The large amount of existing research surrounding the importance of nature and aesthetics supports the importance of adequate provision levels of POS for all communities regardless of the level of density in the

area. Urban planners can utilise research surrounding this topic to drive the provision levels within their local areas to ensure that all residents are provided with spaces that they can enjoy.

Cultural significance was not considered important by participants in my study, although the Blacktown local government area is made up of 37.6% of residents who were born overseas (Blacktown City Council, 2016a). The level of residents born overseas in the Blacktown local government area is 10% higher in comparison to the NSW state average of 27.6% of the population born overseas (Australian Bureau Statistics, 2017). This high percentage of residents born overseas brings a large multicultural community expressing different and varied views and ideas about how POS can be valued by different cultures within the Blacktown City Council area. This result is consistent with the similar study completed by Ives et al. (2017). In the study by Ives et al. (2017), cultural significance was also the lowest rated quality of POS by residents surveyed in the Lake Macquarie and Port Stephens regions of NSW. The consistency in these findings between my study and Ives et al. (2017) demonstrates that residents are placing more value on other factors of importance relating to the features of POS, including things such as nature and aesthetics.

The data collected to answer the first research question determined that although all participants in both high- and low-density living area value POS equally, they reported using POS differently. Whilst the frequency of POS visitation is similar, residents living in high-density areas report staying in the space for longer. Urban planners must understand the impact that the provision of POS can have on their communities because of the differences identified between high- and low-density participants, such as the differing perceptions of important POS qualities and differences in the length of time spent using POS. In the same way, urban planners need to understand the negative impacts that could occur should suitable POS not be provided for their communities.

5.3 Socio-demographic data and public open space

The socio-demographic characteristics of participants did not largely differ between high- and low-density residents. Although there was a larger response rate from older residents in the over 56-years-of-age group, there were sufficient participants to capture the values and use of the younger age groups and provide an insight into the wider Blacktown population. The reason more residents over 56 years of age responded could have been because they had more time to complete the survey as they may not have been in full-time employment. There was a considerable percentage of residents who reported that they were retired. The intention of the study was to identify trends which can be applied to the wider population, rather than specifically represent the population within the geographical sample zones so that the study can be used to provide insight into planning and health in a broad sense. A similar population demographic who completed the survey was also present in the Lake Macquarie POS study by Ives et al. (2017). This could be due to the same population of retirees answering paper based surveys.

5.4 Health status

My research study indicated a positive response to residents' perceptions of their current health status. The majority of participants categorised their health as either good, very good or excellent. There is a possibility that the data captured may not have reached those residents who were not well enough to read and respond to the questionnaire. The positive perception of health status in my study does not correspond to the high rate of chronic diseases in Western Sydney such as obesity and diabetes (Western Sydney Local Health District, 2016). However, self-reported data could also be varied, as human perception of being well or unwell is subjective to the individual person. Rosenman et al. (2011) propose that response bias is common when self-reporting health data and could be due to participants not understanding the reference of the question, or simply wanting to provide a largely

positive image of themselves. The results in my study could be due to response bias and are not necessarily reflective of wider health data captured in larger studies (Western Sydney Local Health District, 2016).

Western Sydney Local Health District (2017) have identified in their most recent health services plan, that the increase in the population base of Western Sydney is a key driver to improve health services in the region. This population has a wide and complex range of health service requirements, and is made up of a range of identified target groups such as those who speak a language other than English at home, identify as Torres Strait Islander or Aboriginal, or are aged 70 and over. These groups require unique and adaptable health services to meet their needs. In my study, BMI status was calculated using self-reported height and weight, and identified that the majority of participants were in the normal range. An association existed between BMI and the reported length of time participants usually spent at their POS. This finding is similar to that of Sanders et. al. (2015) who found an inverse relationship between BMI and POS accessibility in children. When the availability of POS increased, a related decrease in BMI was identified. The relationship found in my study is difficult to determine without obtaining data relating to the time spent partaking in each activity in POS. However, it supports that a substantial consideration should be given to POS and the role that it can play in the improvement of health for each of the specialised population groups identified in The Western Sydney Local Health District (2017) health services plan.

The Western Sydney Local Health District (2017) health services plan identified six target populations who have significant health needs in comparison to the wider population of the Western Sydney area. These six groups are: people living with a mental illness; Aboriginal people; people from diverse cultural groups; older people; people with chronic and complex conditions; and children, young people and families. The plan identifies that as

the Western Sydney population grows, more complex conditions that are related to each of the six target population groups will arise. As a solution to this issue, the Western Sydney Local Health District (2016) health services plan suggests that “we need to prevent serious illness by promoting healthy lifestyles and empowering people to take control of their health” (p.14). Every single one of the six population target groups should be able to access POS and use it as a tool to ensure that they can live active and healthy lifestyles. POS is one of a limited amount of free and accessible resources that each of these groups could use with ease, if the space is planned well and residents’ needs are taken into consideration.

Factors that contribute to the health of an Australian suburb were investigated in a recent study by Domain in Sydney, in partnership with Deloitte Access Economics and Tract Consultants (Johnstone, 2018). These factors were grouped into three categories based on the influence they have on the suburb. The categories were recovery indicators, hindrance indicators and promotion indicators. Recovery indicators are factors that help a resident to recover from illness or disease; hindrance indicators are elements that hinder a resident’s ability to live a healthy lifestyle; and promotion indicators are factors that encourage a resident to engage in living a healthy lifestyle (Johnstone, 2018). Of the 10 factors presented, five were related to the built urban environment and its relation to POS. These factors were walkability, active transport to work, open space, tree cover and access to fresh food/supermarkets. Suburbs were given a rating out of 5 based on the presence of these 10 factors within the suburb. Blacktown received a star rating of 2.5.

The reliability of this study is not yet understood as the full report was not yet available at the time of writing, however, it is noted that the presence of a commercially driven partnership, such as Domain with its real estate interests, may create bias within the results when available. The average health rating of Blacktown is reflective of the high rates of disease found by the Western Sydney Local Health District (2016), however, it is

contradictory to the high self-reported health status found in my study. The factors related to POS presented in the study by Johnstone (2018) are all elements that should be considered by urban planners when developing POS. The findings of my study identify that residents living in high-density areas visit POS more regularly, and should be given consideration to differing elements within the built environment to encourage this use.

The World Health Organisation recognises the impact that the built environment can have on the health of a community, and the positive economic impacts that can result from the decrease in healthcare costs to wider society (World Health Organisation, 2010). In 2010, the World Health Organisation convened the Urban Planning, Environment and Health meeting with delegates representing countries across Europe, in an effort to understand current concerns and develop policy advice on urban planning for health (World Health Organisation, 2010). A key outcome of this meeting was identifying that local governments need to implement policies and regulations at a local level in order to relate to the context of their local communities. As previously identified in the literature review, there is currently no standard or regulation for provision levels of POS within the urban planning industry, either locally or internationally (NSW Department of Planning, 2010). Whilst my research study is consistent with the idea of developing local understanding of a community, it is an unrealistic expectation that each local government undertakes their own research to investigate a suitable provision level for their communities. The resources, time, skill level and political support required to do this would limit the ability to produce a high standard of research in a timely manner (World Health Organisation, 2010). My study has identified only a limited range of data from a small sample of the Blacktown local government area that demonstrates the need for well-planned POS that is fit for purpose and desirable to a wide range of demographics to encourage higher usage levels. There is a substantial amount of further research that would need to be undertaken to determine a suitable provision level.

Thompson (2007) identifies the need for health impact assessments to be undertaken in the wider urban planning industry in both high and low-density areas when assessing development applications and proposed plans before they are approved and become a living reality. Similarly, the World Health Organisation suggest that a range of “environmental parameters are to be considered for a more holistic assessment of the urban environment” in existing cities as well as future developments (World Health Organisation, 2010). Part of this assessment could involve meeting the criteria of a POS provision standard, should it be developed. Health industry professionals and urban planners have the ability to work together to make a significant impact on the health of the community when all considerations are taken before approval is granted. However, as this concept develops and becomes a more topical concept for implementation, guidelines need to be provided to ensure that these relationships are understood and implemented consistently across the state, the country and the world (World Health Organisation, 2010). The high value that residents place on POS in my study shows the need and desire for residents to easily access adequate POS near their homes.

The residents in my study reported their health status as high, despite the negative ratings of studies such as those conducted by the Western Sydney Local Health District (2016) and Johnstone (2018). The relationship found between BMI and length of time spent using POS demonstrates the positive impact that access to POS can have on the health of a population. This impact should be at the forefront of all planning to ensure that the most positive outcome for the health of future communities. As identified by the World Health Organisation (2010) health professionals and urban planners need to work together to ensure that POS can be utilised as a health promotion tool to encourage active and health lifestyles, leading to positive health impacts in the future.

5.5 Contribution and significance of work

The aim of my study was to understand how high- and low-density residents value and use their POS and whether this differs between these two populations. This study fills a gap within urban space research surrounding high- and low-density residents and understanding their patterns and perceptions regarding POS value and usage. The development of a specific survey instrument, developed for use in my study, will contribute to future research as the survey may be modified and utilised for future studies. My research contributed to the local government industry by confirming the importance of partnering with an educational institution to conduct sound and valid research. These two contributions will be discussed in this section.

5.5.1 Tool development and future use

The Public Open Space Survey 2017 in my study was developed due to the limited availability of specific survey instruments which gauged both POS values and health data. In the development of this tool, a thorough review of existing research was carried out to identify any existing survey instruments which collected data related to some part of this research. In reviewing other existing surveys, one survey instrument was found related to the values of POS in an Australian landscape. The Open Space Survey 2013 created by Ives et al. (2017) sourced the values of POS with a focus on geographical information systems and mapping responses. The questions in The Open Space Survey 2013 that were focused on how a resident values POS were extremely relevant to my study. As such, some of these questions were modified to be more relevant to the Blacktown local government area and formed the basis of the new survey that was developed specifically for use in the study reported in this thesis. The use of the geographical mapping system to collate responses as in the study by Ives et al. (2017) was outside the scope of my study, so was not considered to be replicated.

The Public Open Space Survey 2017 (Appendix 1: Consent form and Questionnaire) developed for my study has the ability to be modified for use in a number of areas within local government and the wider health industry. Responses related to value and usage of POS would be of most interest to local governments, whilst the self-reported health data and its relationship with POS usage would be of most interest to health professionals. These elements of the survey collated measurable and specific data related to elements of value which could be utilised by both professions for future planning purposes. As local governments are consistently aiming to understand the wants and needs of their community when planning new infrastructure, planning for population growth or planning for the redevelopment or re-zoning of POS, the survey in my study could be utilised in each of these scenarios. Data gathered from such a survey could assist local government in understanding the importance and value that residents place on their surroundings. The survey instrument could also be utilised in a way to show the impact of a development project such as a park upgrade or installation of new assets within POS if conducted before the changes and repeated upon project completion. Should the survey be used in the future, it could be an effective tool for data collection to measure the changes in any of these cases, and their positive or negative impact on residents' value and usage of POS.

5.5.2 Contribution to local government research

My study utilised a purposive sample selected from high- and low-density areas within the Blacktown City Council local government area. Each area was selected based on its residential zoning as well as certain characteristics related to POS accessibility and features of local POS. These populations can be representative of similar zoning structures in other local government areas, which are categorised across the state. Whilst each zoning category is specific to each local government area, all plans are governed by the NSW

Department of Planning and Environment to ensure consistency and regulatory control across the state (NSW Government Department of Planning and Environment, 2019).

The most common age group of study participants was 56+. This is not representative of the wider Sydney median age of 38 years old, or Blacktown local government area of 33 years old (Australian Bureau Statistics, 2016a). The mean number of people living in a household within my study was 3 people. This is representative of both the wider Blacktown local government area, and the wider Sydney area which also have means of 3 people living in each household (Australian Bureau Statistics, 2016a). The BMI results calculated in my study found that 55% of participants were either overweight or obese. Whilst data for the wider Blacktown local government area is lacking, this figure is similar to the status of wider Australia, where 63% of Australians are considered to be overweight or obese based on their BMI results (Australian Institute of Health and Welfare, 2019).

Whilst some findings and results within my study are representative of the wider Blacktown local government area or greater Sydney area, there are some areas of the study that are not. My study has contributed to the urban planning industry by responding to the call to determine more specific and achievable specifications for POS planning and design to encourage physical activity and higher usage levels (Sugiyama et al., 2018). In order to be representative of a wider population or generalisable across wider areas, my study needs to be repeated by other researchers in differing geographic areas. The partnership that has been experienced between an academic institution and local government within my study has the ability to provide important results in a well-planned and effective way in other local government areas.

A common practice in local governments is to either engage a third-party consulting organisation, or to use internal staff to produce and conduct research. Due to ongoing

budgetary restraints in government organisations, staff are often required to develop and produce research without extensive background experience, knowledge or skills required to conduct research (Searle, 2011). The quality of the data and the research findings can be negatively affected when poor research processes are utilised. Inappropriate research approaches may result in residents being consulted without the appropriate consideration to sampling, methodology or analysis. Local governments are often left without a strong response rate or clear direction for the project.

An approach to overcome the limitation of budgets is to partner with researchers through educational institutions to conduct high quality, valid research. This allows a planned approach to the research and ensures thorough methods and processes are adhered to in a cost effective manner. My study demonstrates the ability for local governments to partner with educational institutions to gain essential information for future planning of POS relative to the context of the local government area, rather than engaging a consulting organisation without the background knowledge and insight to the area in which the study is being conducted.

In my study, a method of research was used that had not been previously tested in the recreation planning sector of the partnered local government area. A significant benefit of partnering for this study was the improved response rate for the research when comparing it to the response rate of previously distributed surveys that were administered for the purpose of community consultation. Previously, the local government did not track response rates and engagement data with the survey population (A Stafford, personal communication, August 20, 2018). The provision of a formal survey, which is then put through a thorough statistical analysis, presenting final results to the participants as well as the local government decision-makers to have a substantiated analysis to then act upon, is not a common occurrence within the local government industry. My survey provides a previously tested, ready-to-use tool that

will assist in allowing this level of research and analysis to be achieved within other local government areas. The potential flow on effect of utilising this survey is educated decision-making leading to well-planned spaces which encourage healthy living for current and future residents.

The purposive sampling approach used, in addition to the incentives, had the desired effect of a positive response rate, relative to other council led community surveys. The introduction of incentives such as monetary payments, gifts, vouchers or prize draws (London, Jr, Bhan, & Network, 2012) can be used to compensate participants for their expenses, their time or inconvenience experienced through participation in a research study (Economic and Social Research Council, n.d.). The survey process also involved the distribution of follow-up reminder cards to the survey population to encourage response rates in the last month of the survey-response period.

Discussions between the research team and Blacktown City Council representatives determined that an incentive was appropriate to use as a sample group as previous Council research had been difficult to recruit. The incentive chosen was the opportunity to win one of two \$100 gift vouchers to the large shopping centre in the centre of the local government area. Debate surrounds the topic of whether it is unethical not to compensate participants, or whether it is ethical to attract participants through incentives to a situation which may cause them harm. It is the responsibility of the research team to ensure that an appropriate balance is achieved between these two considerations (Gelinas et al., 2018; Groth, 2010).

In 2018, the Australian Government National Health and Medical Research Council (NHMRC) released draft guidelines for the payment of participants in research (Australian Government National Health and Medical Research Council, 2018). Many institutional bodies agree that when there is no harm to the individual, incentivising participation to

increase the number of people participating in research can be a positive thing (Zutlevics, 2016). These guidelines suggest that payment of participants should be “equitable and proportionate to the burden of the research” (p.4). The guidelines suggest that it is appropriate to use an incentive when it is reimbursing significant time or inconvenience for taking part in the research, when the researcher is trying to attract a significant target group, or when the research provides no benefit to the participant (Australian Government National Health and Medical Research Council, 2018). The use of a random prize draw as an incentive in my research was considered appropriate after consideration through an institutional ethical review. The impact on participants was minimal, participation voluntary, and the incentive of small monetary value. All of these considerations met the requirements of the NHMRC draft guidelines for payment of participants in research (Australian Government National Health and Medical Research Council, 2018).

The development of a survey tool that can be utilised in other local government areas to improve their understanding of community values is a contribution to the urban planning and local government industry, which has the ability make a considerable impact to the future of the POS and recreation planning industry. When produced alongside the introduction of methods such as university partnerships and incentives to encourage high level research findings, the ability to guide change within the local government industry increases.

5.6 Limitations of the study

The research questions in my study aimed to understand how high- and low-density communities value and use POS, and whether there were significant differences between the views of these two types of residents. Whilst my study achieved this aim, the impact that this research aimed to achieve through informing local government, policy makers and planning agencies of the value and use of POS will be limited. The study was limited to the

Blacktown, NSW local government area, and is yet to be conducted in other geographical areas to confirm its validity and impact on the industry.

There was a large representation from residents aged 56 years and over in my study. This could be due to the methodology chosen and the distribution of mailed surveys to residential addresses. Whilst online submission was encouraged, mailing a return survey takes a substantial amount of time. Residents in this age group may be less likely to have full-time employment or family commitments, and therefore took the time to respond to the survey whereas responses from younger residents were low. My study was limited in distribution approach due to the contact information being unavailable for a wider range of residents through the local Council.

The format of an online survey may encourage higher response rates in future similar forms of research as the study outlined in this thesis. Whilst the response rate of 14.8% for this research was sufficient, a higher response rate of up to 20% is desired. Time and financial resource limitations dictated the reach of participants for my study. If this was not a limitation, a larger sample size and response rate could be achieved. The survey could also have a larger reach if it was produced in a number of languages common to the area due to the high rate of residents who speak a language other than English at home within the Blacktown area.

The survey was cross-sectional in nature and therefore collected self-reported health data from residents at the time of the survey, including their height and weight, as well as a rating on their current health status. Self-reported health data is limited in nature due to the potential for misinterpretation and bias of the participant. This survey did not have the available scope to collect clinical data from residents, so self-reported data were considered sufficient for the purposes of this research.

It was evident upon collation of data that there were some questions in the survey which were misunderstood and did not present answers as intended. Question 14 was an imagery based question which presented the participant with six images of varying public open spaces. The participant was asked to rate each image between 1 (poor) and 5 (excellent) on a Likert scale. Some responses to this question provided a ranking of the images as 1 through 5, leaving one image without a response. The instructions for this question were not clear enough to direct the intended response. If the survey tool is used again in the future, it is recommended that the researcher revise the instructions for this question by providing a more detailed request.

Although the survey was reviewed by a number of people internal and external to the research team, a full pilot was not conducted to test the newly developed survey. In hindsight, the issues associated with the imagery question could have been identified in a thorough pilot study. Polit and Beck (2017) identified that pilot studies can be used to recognise issues with data collection instruments such as variability in responses, missing data, comprehension and to estimate time needed to disseminate and collect the survey.

Whilst there were limitations relating to the development of the survey tool and distribution and collection of data, the data collected were extremely informative and were used to answer all research questions asked.

5.7 Recommendations for future research

Through the development and completion of my study, a number of recommendations can be made. These recommendations may be useful in to guide future research, in addition to capacity building within both the urban planning, local government and health industries. Recommendations, presented below, are based on the learnings of the research and the

outcomes of the methodological approach taken to conduct this study. Recommendations covered in this section include:

- Further exploration of the characteristics of people living in high- and low-density areas and the differences between them are needed.
- Further exploration of specific activities undertaken by each family member, as well as distance travelled to visit specific POS are needed.
- In future research, consider questionnaire distribution using an online platform with question modifications to improve responses.
- In future research, exploration of specific requirements of POS distribution and provision levels within high- and low-density areas is needed to assist the development of a suitable guideline that acknowledged these requirements.
- Exploration of partnerships between local governments and academic institutions, to produce high quality and valid research within the urban planning and health fields.

Whilst this research has gained an insight into how high- and low-density residents value and utilise POS, there is limited research available about specific POS requirements for high- and low-density residents and how their needs might differ. As such further exploration is recommended into differences between demographic information, family structures, value and use of POS and the reasons behind these usage levels and perceptions of value. There is a need for further exploration of the characteristics of people living in these two residential zonings and the differences between them. Should further research be conducted, the data would be of use to local government and state planners, to ensure that provision levels and design are sufficient to encourage a healthy and active lifestyle, however there is still a wide expanse of knowledge to be gained on this topic.

Although not statistically significant, it was interesting to note the difference in use of POS between people with children living in their home and those with no children living in their home. Regularity of visits to POS was positively correlated to the number of children under 17 years of age living in the household. The data collected in my research only explored visitations to the closest POS to the resident's home, however, an interesting topic for further exploration may be to understand other activities that these participants could be engaging in. For example, although residents did not visit their closest POS, they could have been travelling further to visit more engaging POS that was more suited to their needs. Further to this, the data collected in my study did not identify which activities each family member was participating in. Further research could focus on the specific activities that each family member participated in, compared with the demographics of that person.

Should the survey be repeated, changes could be made to the questions in the survey which confused the reader, resulting in an invalid answer to the question. The questions with limitations were detailed in the methodology section of this report. Changing the format of the questionnaire to an online-based platform would be beneficial if the contact data were available.

After review of existing literature in the field of urban planning, the lack of a POS provision level that is widely accepted within the industry was a topic of concern. Consideration has not been given to a provision level dependent upon density of the area, in research literature or government reports. My research has identified the differences in value and use between high- and low-density communities, however, a provision level could be further explored to determine what practices planners should be considering when assessing provision of POS in these types of developments.

The partnership within my study between the local government and an academic institution is recommended for any future research in the field. This partnership allowed the research to provide essential information to assist in future policy and planning practices within the local government. The ability to achieve high quality and valid research is assisted by this partnership as the academic institution is able to develop their skills and knowledge to provide a mutually beneficial outcome of gained knowledge within the urban planning and local government industries.

5.8 Conclusion to the chapter

This research has revealed a number of key ideas which have been explored throughout this chapter. Whilst the research revealed that the study population highly value their nearby POS, it is clear that it is used differently by residents living in high-density areas in comparison with their low-density counterparts. The differing uses include the time spent visiting, activities undertaken, and features valued within the space. Consideration of these findings must be given by urban planners and designers who are required to provide POS that fits the wants and needs of their communities to encourage higher use. The flow-on effects of this higher usage may result in the improvement in health-related outcomes, such as the increase in physical activity and reduction of chronic disease indicators. Whilst there are some limitations within this research, my study provides a platform for which further research in this field can be undertaken to gain a wider understanding of how high- and low-density communities may require different POS provision levels.

Chapter 6: Conclusion

The key findings and study outcomes of this research are summarised in this chapter. The chapter also includes a summation of the implications of these findings and potential integrations within the recreation planning and health industries.

POS has the ability to positively or negatively impact a community. POS can be utilised by the community as a place for physical activity or exercise, a place to socialise, or simply a place to sit and relax. POS has the ability to positively impact a community's health, economic, social and environmental status. The aim of my research was to determine whether or not high- and low-density communities value and use POS differently, and therefore desire different qualities in POS in Blacktown, New South Wales, Australia. Findings from this research, presented in this thesis, have the potential to inform the activities of local governments across Australia, including regulatory and planning bodies who are involved in planning POS within their geographical areas of control. The findings also have the potential to inform discussion of whether planning provision guidelines and distribution of POS need to change, depending upon density of the surrounding neighbourhood.

In order to answer the research questions, a newly developed questionnaire was distributed to capture data from a purposeful sample of 1089 residents living in either high or low-density areas of the Blacktown Local Government Area, NSW. This survey included a series of questions relating to the patterns of usage and perception of value towards the residents nearby POS. Sociodemographic and self-reported health data were also collected. Sociodemographic data and self-reported health data were also collected. The quantitative data were analysed using SPSS software to obtain descriptive and comparative statistics. These statistical tests were then used to identify significant findings within the data.

Overall, the research questions focused on how communities in high- and low-density areas value and use POS. From the data gathered to answer the research questions, comparisons were made between responses from participants in high- and low-density areas to identify any significant differences or similarities. The research questions that the study answered were:

1. In high- and low-density communities:
 - a. How important is public open space to residents?
 - b. What qualities of public open space are most important to residents?
 - c. What activities do residents undertake in public open space?
 - d. What is the level of use of public open space and how does this vary?
2. What socio-demographic factors influence the qualities and activities undertaken in public open space?
3. In all communities, does a high self-reported health status compared to a low self-reported health status impact on how the participant values and uses public open space?

The findings that were identified from this study suggested that, whilst both high- and low-density areas equally valued their POS, it was used differently by each group. High-density residents spent more time at their nearby POS undertaking a wider range of activities than their lower density counterparts. This finding may be reflective of the minimal private open space in high-density dwellings which leads to POS acting as an extension of the home. The most popular activity undertaken in POS was walking, followed by playing with children and sitting/relaxing. These activities are important for exercise, health and family time therefore, consideration should be given to features which facilitate these activities in the

planning and development of POS to encourage use by the nearby population regardless of the level of housing density.

The data collected during the study about the participants' socio demographic information did not show major differences between residents living in high- and low-density communities. Consistency was identified across the survey population in relation to children in the home and participants who exercised their dog in POS. That is, participants who had children living in their home were more likely to use nearby POS compared to participants with no children living at home. Participants who used POS to exercise their dog visited the space more frequently. Further research to explore the activities that each household member undertake in POS would be useful to increase the understanding of POS usage and the impact this could have on the urban planning process.

The built environment can have a large impact on an individual's health. A positive perceived level of health was reported across the survey population. A relationship was identified between BMI and time spent visiting POS. This supports the wide body of literature regarding the positive health impacts that POS has on a number of chronic health conditions. As the presence of chronic disease increases within Australia, the importance of providing POS with well-designed features specific to community needs will support health outcomes for the community.

My study has contributed to the body of research surrounding POS and the future of its provision within the ever-increasing high-density living arrangements in expanding cities. The findings of my study can be considered as a starting point for the recreation and open space planning industry when considering levels of POS that are suitable for both high- and low-density residential areas and the different ways that POS is utilised by each group. The questionnaire developed in this study could be utilised by other local governments or industry

professionals could increase the potential for this research to impact other areas of Australia and lead to strategic changes across the recreation and open space planning industry.

Partnerships between academic institutions and local governments to conduct further research within the POS field focusing on high- and low-density populations should be encouraged to produce sound and valid research recommendations which urban planners and policy makers can easily integrate into their community planning practices.

The development of a POS provision standard suitable to a high- and low-density community will take time, a significant mindset change by planners and policy makers, and further research. My study demonstrates the differing needs between high- and low-density communities and the positive impact that POS can have on nearby residents. It is crucial that a community's needs are considered in the development of a POS provision standard due to the variances in the way that POS is used by each community. By working together, urban planners, policy makers, health professionals and academics can contribute to the wider improvement of communities and their health.

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Appendices

1	Consent form and questionnaire
2	Reminder Card
3	Ethics approval letter
4	Data tables for survey questions not analysed
5	Five Point Likert Scale Responses

Appendix 1: Consent form and Questionnaire

Public open space survey 2017

You are one of a select group of residents invited to take part in a study on how our community values and uses public open space.

Public open space is land available primarily for sporting and recreation activities. This includes Council owned or managed land and state government land.

Please have ONE person in your household answer the attached survey questions. This person should be chosen at random. The survey should take less than 10 minutes to finish.

The answers will help us understand the importance you place on public open space in your area. It will also assist in local and regional planning in the Blacktown Council area.

You must be over 18 years of age to take part in this study. By completing and returning this survey, you are agreeing to us using your answers in the research report. Your answers and personal details are confidential and will not be published. There are no consequences if you do not complete this survey.

To thank you, we will enter your name in a draw to **win one of two \$100 Westpoint Shopping Centre vouchers** when we receive your completed survey.

Simply return your survey to us by post, email, or in person – see below.

Post	Att: Megan Williams Recreation Planning and Design Blacktown City Council Po Box 63 Blacktown NSW 2148
Email	Megan.williams@blacktown.nsw.gov.au
In person	Information Desk Blacktown Civic Centre 62 Flushcombe Rd Blacktown NSW 2148

If you have any questions on the survey, please contact our Recreation Planner and Project Officer, Lyndall Smedley on 9839 6329.

This research study has been approved by Blacktown City Council and the Avondale College of Higher Education Ethics committee.

Please remove and keep this page

Public open space survey 2017

Participant Consent Form

The perceived value and use of public open space in high and low-density communities

Researcher: Lyndall Smedley s627695@student.avondale.edu.au

I agree to participate in the above research project and I give my consent freely.

I have read and understand the information provided in the Information Statement.

I understand that the project will be conducted as described in the Information Statement, a copy of which I have been given to keep.

I understand I can withdraw from the project at any time and do not have to give any reason for withdrawing. I will not be disadvantaged in anyway by withdrawing.

The processes required for the project and the time involved have been explained to me. I have had the opportunity to ask questions and have had them answered to my satisfaction.

I consent to:

- Completing the Public Open Space survey 2017

I understand that my personal information will remain confidential and my answers will not be traceable to me.

This research project has been approved by the Avondale College of Higher Education Human Research Ethics Committee (HREC). Avondale requires that all participants are informed that if they have any complaint concerning the manner in which a research project is conducted it may be given to the researcher, or if an independent person is preferred, to Avondale's HREC Secretary, Avondale College of Higher Education, PO Box 19, Cooranbong NSW 2265, or phone (02) 4980 2121 or fax (02) 4980 2117 or email: research.ethics@avondale.edu.au

Print name _____ Signature _____ Date _____

Part 1: Public open space survey 2017

1. How important to you is public open space? (circle one box)

Not at all important	Not very important	Neutral	Important	Very important
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2. How important is health to you? (circle one box)

Not at all important	Not very important	Neutral	Important	Very important
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3. In general, how would you rate your health? (circle one box)

Poor	Fair	Good	Very good	Excellent
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4. How important to you are the following general qualities of public open space (select one box per line)?

	Not at all important	Not very important	Neutral	Important	Very important
Nature (plants and animals)					
Opportunity for physical activity					
Opportunity for social interaction					
Health/therapeutic benefits					
Aesthetically pleasing/scenic					
Cultural significance					

5. How important to you are the following features of public open space (select one box per line)?

	Not at all important	Not very important	Neutral	Important	Very important
Car parking					
Dog off leash area					
Fitness equipment					
Landscaping (trees, gardens)					
Open green space to play sport					
Outdoor courts (basketball/tennis/netball)					
Picnic area					

Playground					
Seating					
Skate park					
Toilets/amenities					
Walking paths					
Other (please detail):					

6. How much would the following would deter you from using public open space (please select one box per line)?

	Not at all	Not a lot	Neutral	Somewhat	A lot
Poor security (feels unsafe)					
Poor lighting					
Poor maintenance (long grass/rubbish)					
Poor access (no footpaths or walkways)					
No seating					
No toilets					
Unappealing (nothing to do there/doesn't suit your needs)					
Other (please detail):					

7. In the last week, how many times did you visit public open space?

0	1	2	3	4+
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8. What is the name of the public open space closest to your residence (reserve or street name)?

9. How often do you visit the public open space closest to your residence? (please circle one response)

Never	Once a month	Once every two weeks	Once a week	More than once a week
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10. When you visit this space, how long do you usually stay? (please circle one response)

I never visit	Less than 30 minutes	30 minutes – 1 hour	1 -2 hours	More than 2 hours
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11. When you visit this space, what do you do? (please check all that apply)

Exercise the dog	
Observe nature (plants/animals)	
Physical exercise/fitness activities (not including organised sport)	
Organised sport	
Play with my children	
Sit/relax	
Socialise with others	
Walk	
I do not visit this space	
Other (please detail):	

12. How much would the following attract you to visit and use your closest public open space more often (please select one box per line)?

	Not at all	Not a lot	Neutral	Somewhat	A lot
Improved infrastructure (e.g. playground, fitness equipment, toilets)					
Improved maintenance					
Enhanced accessibility					
Improved landscaping					
More natural features					
More activities to do in the space					
Having someone to go with					
Other (please detail):					

--	--	--	--	--	--

13. Please look at the images below. Place a circle around the image that you like the best and put a cross through the image you like the least.

Once this question is complete, you will have a circle around one image and a cross through one image.



14. Please look at the images below and rate each one between 1 (poor) and 5 (excellent)?









15. How old are you? (please circle one response)

18-25	26-35	36-45	46-55	55 +
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16. Are you: ☐ Male ☐ Female

17. What is your height? _____ cms

18. What is your weight? _____ kgs

19. What type of home do you live in? (please circle one response)

House	Townhouse	Apartment	Other
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20. How many people live in your home? _____ people

21. How many people aged 17 or under live in your home? _____ people

a. How old are they? _____ years

_____ years

_____ years

_____ years

22. How long have you lived in your current home? _____ years

23. What is your employment status?

Retired	Unemployed	Casual employment	Part time employment	Full time employment	Self- employed
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24. What is the nearest intersection to your home?

Part 4: Where to from here?

Please note: The information on this page will be stored separately from the survey answers and will not be linked to your responses.

Survey findings

I would like to be kept informed of the survey findings, my email address is:

Thank you draw

I would like to go in the draw to **win one of two \$100 Westpoint Shopping Centre vouchers:**

Name:	
Phone:	
Email:	

Focus groups

We will be holding focus groups with residents in late 2017 to further explore their wants and needs for public open space. The focus groups will run for about one hour, and information from these discussions will allow us to better provide services and facilities in the future.

I would like to take part in focus groups on this topic later in the year. I understand that nominating my interest does not mean I will be asked to attend.

Name:	
Phone:	
Email:	

Thank you for taking the time to complete this survey.

Appendix 2: Reminder card



Public open space survey 2017

You are almost out of time to complete our Public Open Space Survey and go in the draw to **win one of two \$100 Westpoint shopping centre vouchers!**

We are very interested in how our community values and uses public open space. Your answers will allow us to better plan public open space in the Blacktown Council area.

If you did not receive the survey recently mailed out, or have lost your copy you can complete your survey online at:

<https://www.surveymonkey.com/r/publicopenspace2017>

Be quick, the survey closes on Friday 6th October 2017.

TO THE RESIDENT

XXXXX

BLACKTOWN,

**Human Research Ethics Committee**

Telephone: 02 4980 2121

Fax: 02 4980 2117

Email: research.ethics@avondale.edu.au

28 July 2017

Lyndall Smedley
C/- Avondale College of Higher Education
582 Freemans Drive
COORANBONG NSW 2265

Dear Lyndall

Thank you for submitting an application for ethics approval to the Avondale Human Research Ethics Committee for your project entitled *The perceived value and use of public open space in high and low density communities*.

I am pleased to advise that final approval is granted for your project. Approval is granted for the duration of your project to 31/12/18; project number 2017:14

Once final approval is granted, the following additional standard conditions apply:

1. That you notify the committee of any changes to circumstances or research design, which might require a review of the ethics approval.
2. That you provide an annual interim report of your progress to the committee, and a final report once this project is completed. The first report will be due twelve months from the date you commence the research.

We wish you well in this valuable research endeavour.

Sincerely

A handwritten signature in black ink, appearing to read 'Kyllie Gow', written over a light blue horizontal line.

Kyllie Gow
Secretary
Avondale Human Research Ethics Committee

Appendix 3: Ethics approval letter

Appendix 4: Data tables for survey questions not analysed

Table 23.

How much would the following deter you from using public open space?

	Not at all	Not a lot	Neutral	Somewhat	A lot	Total
Poor security (feels unsafe)	2 (1.2%)	3 (1.9%)	13 (8.3%)	39 (24.8%)	100 (63.7%)	157
Poor lighting	2 (1.3%)	7 (4.4%)	15 (9.5%)	49 (31.0%)	85 (53.8%)	158
Poor maintenance (long grass/rubbish)	0	3 (1.9%)	8 (5.1%)	23 (14.6%)	123 (78.3%)	157
Poor access (no footpaths or walkways)	0	4 (2.5%)	16 (10.1%)	41 (25.9%)	97 (61.4%)	158
No seating	4 (2.5%)	5 (3.2%)	18 (11.4%)	61 (38.6%)	70 (44.3%)	158
No toilets	2 (1.3%)	5 (3.2%)	23 (14.5%)	47 (29.7%)	81 (51.3%)	158
Unappealing (nothing to do there/doesn't suit your needs)	1 (0.6%)	4 (2.5%)	25 (16.1%)	41 (26.4%)	84 (54.2%)	155
Total	11	31	118	301	640	

Table 24.

How much would the following attract you to visit and use your closest public open space more often?

	Not at all	Not a lot	Neutral	Somewhat	A lot	Total
Improved infrastructure (eg. Playground, fitness equipment, toilets)	6 (3.8%)	4 (2.5%)	13 (8.3%)	36 (22.9%)	98 (62.4%)	157
Improved maintenance	3 (2.0%)	6 (4.0%)	19 (12.6%)	39 (25.6%)	84 (55.6%)	151
Enhanced accessibility	5 (3.4%)	9 (6.2%)	40 (27.4%)	39 (26.7%)	53 (36.3%)	146
Improved landscaping	3 (2.0%)	7 (4.7%)	20 (13.3%)	43 (28.7%)	77 (51.3%)	150
More natural features	3 (2.0%)	9 (6.1%)	25 (16.9%)	43 (29.0%)	68 (45.9%)	148
More activities to do in the space	2 (1.3%)	5 (3.4%)	18 (12.3%)	44 (30.1%)	76 (52.1%)	146
Having someone to go with	12 (8.4%)	15 (10.5%)	43 (30.3%)	37 (26.1%)	35 (24.6%)	142
Total	34	55	178	281	491	

Appendix 5: Five Point Likert Scale Responses

Table 25.

Value of public open space

	Low-density (%)	High-density (%)	Total
How important to you is Public Open Space?			
Not at all important	0	0	0
Not very important	0	0	0
Neutral	3 (2.7%)	3 (6.7%)	6 (3.8%)
Important	24 (21.2%)	16 (35.6%)	40 (25.2%)
Very Important	86 (76.1%)	26 (57.8%)	112 (70.9%)
Total	113 (100%)	45 (100%)	158 (100%)

Table 26.

Value of health to high- and low-density communities

	Low-density (%)	High-density (%)	Total
How important is health to you?			
Not at all important	0	0	0
Not very important	0	1 (2.2%)	1 (0.6%)
Neutral	1 (0.9%)	1 (2.2%)	2 (1.3%)
Important	23 (20.4%)	3 (6.5%)	26 (16.4%)
Very Important	89 (78.8%)	41 (89.1%)	130 (81.8%)
Total	113 (100%)	46(100%)	159 (100%)

Table 27.

Importance of general qualities of public open space

	Low-density (%)	High-density (%)	Total (%)	p-value*
Nature (plants and animals)				
Not at all important	0	0	0	
Not very important	0	0	0	
Neutral	4 (3.5%)	6 (13.0%)	10 (6.3%)	
Important	34 (30.1%)	17 (37.0%)	51 (32.1%)	
Very Important	75 (66.4%)	23 (50%)	98 (61.6%)	
Total	113 (100%)	46 (100%)	159 (100%)	
Opportunity for physical activity				
Not at all important	0	0	0	
Not very important	0	2 (4.3%)	2 (1.3%)	
Neutral	9 (8.0%)	5 (10.9%)	14 (8.8%)	
Important	39 (34.5%)	19 (41.3%)	58 (36.5%)	
Very important	65 (57.5%)	20 (43.5%)	85 (53.5%)	
Total	113 (100%)	46 (100%)	159 (100%)	
Opportunity for social interaction				
Not at all important	0	0	0	
Not very important	2 (1.8%)	2 (4.3%)	4 (2.5%)	
Neutral	17 (15.0%)	10 (21.7%)	27 (17.0%)	
Important	49 (43.3%)	14 (30.4%)	63 (39.6%)	
Very important	45 (39.8%)	20 (43.5%)	65 (40.9%)	
Total	113 (100%)	46 (100%)	159 (100%)	
Health/therapeutic benefits				
Not at all important	0	1 (2.2%)	1 (0.6%)	
Not very important	2 (1.8%)	3 (6.7%)	5 (3.2%)	
Neutral	20 (17.7%)	4 (8.9%)	24 (15.2%)	
Important	41 (36.3%)	19 (42.2%)	60 (38.0%)	

Table 27.

Importance of general qualities of public open space

Very important	50 (44.2%)	18 (40.0%)	68 (43.0%)
Total	113 (100%)	45 (100%)	158 (100%)
Aesthetically pleasing/scenic			
Not at all important	0	1 (2.2%)	1 (0.6%)
Not very important	1 (0.9%)	0	1 (0.6%)
Neutral	8 (7.1%)	(13.0%)	14 (8.8%)
Important	47 (41.6%)	24 (52.2%)	71 (44.7%)
Very important	57 (50.4%)	15 (32.6%)	72 (45.3%)
Total	113 (100%)	46 (100%)	159 (100%)
Cultural Significance			
Not at all important	8 (7.1%)	2 (4.3%)	10 (6.3%)
Not very important	15 (13.4%)	5 (10.9%)	20 (12.7%)
Neutral	36 (32.1%)	11 (23.9%)	47 (29.7%)
Important	27 (24.1%)	15 (32.6%)	42 (26.6%)
Very Important	26 (23.2%)	13 (28.3%)	39 (24.7%)
Total	112 (100%)	46 (100%)	158 (100%)

Table 28.

How important are general features of Public Open Space?

	Low-density (%)	High-density (%)	Total (%)	p-value*
Car Parking				
Not at all important	0	2 (4.3%)	2 (1.3%)	
Not very Important	4 (3.5%)	1 (2.2%)	5 (3.1%)	
Neutral	12 (10.6%)	7 (15.2%)	19 (11.9%)	
Important	47 (41.6%)	22 (47.8%)	69 (43.4%)	

Table 28.

How important are general features of Public Open Space?

	Low-density (%)	High-density (%)	Total (%)	p-value*
Very important	50 (44.2%)	14 (30.4%)	64 (40.3%)	
Total	113 (100%)	46 (100%)	159 (100%)	
Dog off leash area				
Not at all important	13 (11.5%)	8 (17.4%)	21 (13.2%)	
Not very Important	17 (15.0%)	11 (23.9%)	28 (17.6%)	
Neutral	37 (32.7%)	12 (26.1%)	49 (30.8%)	
Important	24 (21.2%)	9 (19.6%)	33 (20.8%)	
Very important	22 (19.5%)	6 (13.0%)	28 (17.6%)	
Total	113 (100%)	46 (100%)	159 (100%)	
Fitness Equipment				
Not at all important	2 (1.8%)	2 (4.3%)	(2.5%)	
Not very Important	13 (11.5%)	5 (10.9%)	18 (11.3%)	
Neutral	35 (31.0%)	14 (30.4%)	49 (30.8%)	
Important	42 (37.2%)	21 (45.7%)	63 (39.6%)	
Very important	21 (18.6%)	4 (8.7%)	25 (15.7%)	
Total	113 (100%)	46 (100%)	159 (100%)	
Landscaping (trees, gardens)				
Not at all important	0	0	0	
Not very Important	1 (0.9%)	0	1 (0.6%)	
Neutral	6 (5.4%)	3 (6.5%)	9 (5.7%)	
Important	45 (40.2%)	23 (50.0%)	68 (43.0%)	
Very important	60 (53.6%)	20 (43.5%)	80 (50.6%)	
Total	112 (100%)	46 (100%)	158 (100%)	
Open green space to play sport				
Not at all important	0	0	0	
Not very Important	0	2 (4.3%)	2 (1.3%)	
Neutral	10 (8.8%)	6 (13.0%)	16 (10.1%)	

Table 28.

How important are general features of Public Open Space?

	Low-density (%)	High-density (%)	Total (%)	p-value*
Important	46 (40.7%)	17 (37.0%)	63 (39.6%)	
Very important	57 (50.4%)	21 (45.7%)	78 (49.1%)	
Total	113 (100%)	46 (100%)	159 (100%)	
Outdoor Courts				
Not at all important	4 (3.6%)	2 (4.3%)	6 (3.8%)	
Not very Important	9 (8.0%)	2 (4.3%)	11 (7.0%)	
Neutral	25 (22.3%)	15 (32.6%)	40 (25.3%)	
Important	39 (34.8%)	13 (28.3%)	52 (32.9%)	
Very important	35 (31.3%)	14 (30.4%)	49 (31.0%)	
Total	112 (100%)	46 (100%)	158 (100%)	
Picnic Area				
Not at all important	0	0	0	
Not very Important	2 (1.8%)	2 (4.3%)	4 (2.5%)	
Neutral	8 (7.1%)	4 (8.7%)	12 (7.5%)	
Important	40 (35.4%)	20 (43.5%)	60 (37.7%)	
Very important	63 (55.8%)	20 (43.5%)	83 (52.2%)	
Total	113 (100%)	46 (100%)	159 (100%)	
Playground				
Not at all important	0	1 (2.2%)	1 (0.6%)	
Not very Important	2 (1.8%)	2 (4.3%)	4 (2.5%)	
Neutral	13 (11.6%)	8 (17.4%)	21 (13.3%)	
Important	26 (23.2%)	12 (26.1%)	38 (24.1%)	
Very important	71 (63.4%)	23 (50.0%)	94 (59.5%)	
Total	112 (100%)	46 (100%)	158 (100%)	
Seating				
Not at all important	0	0	0	
Not very Important	1 (0.9%)	1 (2.2%)	2 (1.3%)	

Table 28.

How important are general features of Public Open Space?

	Low-density (%)	High-density (%)	Total (%)	p-value*
Neutral	7 (6.3%)	4 (8.7%)	11 (7.0%)	
Important	39 (34.8%)	18 (39.1%)	57 (36.1%)	
Very important	65 (58.0%)	23 (50.0%)	88 (55.7%)	
Total	112 (100%)	46 (100%)	158 (100%)	
Skate Park				
Not at all important	13 (11.6%)	9 (19.6%)	22 (13.9%)	
Not very Important	33 (29.5%)	6 (13.0%)	39 (24.7%)	
Neutral	34 (30.4%)	13 (28.3%)	47 (29.7%)	
Important	19 (17.0%)	13 (28.3%)	32 (20.3%)	
Very important	13 (11.6%)	5 (10.9%)	18 (11.4%)	
Total	112 (100%)	46 (100%)	158 (100%)	
Toilets/amenities				
Not at all important	0	1 (2.2%)	1 (0.6%)	
Not very Important	3 (2.7%)	0	3 (1.9%)	
Neutral	5 (4.5%)	5 (11.1%)	10 (6.4%)	
Important	30 (27.0%)	15 (33.3%)	45 (28.8%)	
Very important	73 (65.8%)	24 (53.3%)	97 (62.2%)	
Total	111 (100%)	45 (100%)	156 (100%)	
Walking Paths				
Not at all important	1 (0.9%)	1 (2.2%)	2 (1.3%)	
Not very Important	0	0	0	
Neutral	3 (2.7%)	3 (6.5%)	6 (3.8%)	
Important	37 (33.3%)	20 (43.5%)	57 (36.3%)	
Very important	70 (63.1%)	22 (47.8%)	92 (58.6%)	
Total	111 (100%)	46 (100%)	157 (100%)	