Spatial Analysis of Urban Parks and COVID-19: City of Whittlesea, Victoria, Australia

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Parks are an important part of the urban fabric of cities. The Victorian Government has made it clear that everyone with a pre-existing medical condition, needs to play a part in controlling the spread of the novel COVID-19 virus. Self-isolation and social distancing from other people will reduce the spread of the virus but may also be impacting negatively on people's physical and mental health. The Government allows people to leave their homes to exercise. For this reason, parks remain open, providing that visitors observe the protocols of not being in groups larger than two (apart from households) and keeping a safe distance of two metres between each other. The purpose of this paper is to explore the mental health conditions across age groups within spatial relationships between park availability and age care facilities in the City of Whittlesea. The association between having a park within 800 m from an aged care facility and the likelihood of having zero, one, two or more aged care facilities nearby was examined.

25.1 Introduction

Urban parks have received attention in recent years as a possible natural factor that could encourage physical activity, prevent obesity, and reduce the incidence of chronic conditions [12]. Despite long hypothesized benefits of parks for mental health, few park studies incorporate mental health measures. COVID-19 related restrictions have accentuated the community's reliance on open space to maintain its physical fitness and stabilise its mental health. It has also been demonstrated that older people are among the most vulnerable to both the effects of policy-induced isolation and disease itself. The benefits gleaned from being able to access open spaces and associated walking trails were demonstrated in Australia [29] and proximity to a park was inextricably linked to an increased frequency of park use, regular exercise and improved mental health [28]. However, the government has encouraged older people to stay at home for their own protection during the pandemic and implemented physical distancing measures to slow the spread of the disease. Unfortunately, older people, especially those in aged care facilities, may not have access to open spaces large enough to enable them to adhere to physical distancing measures within their facilities whilst spending time outdoors. This results in a reduction in social interaction even with the people that they live with and effects their mental health. Those living in aged care homes face additional mobility and psychological challenges that they (and their carers) must overcome before they are able to obtain the benefits associated with spending time in nature. One barrier faced by people in aged care facilities is access to public open space. Population forecasting indicates that, by 2036, there will be an 87% increase in people aged 50+ years in the City of Whittlesea

[17]. The city has committed to investing in, maximising and delivering recreation infrastructure that improves connectivity between places and removes the barriers experienced by older people to promote physical activity, active travel and incidental exercise (profile.id, 2019). To future-proof its investments and deliver equitable wellbeing outcomes there is a need to identify where existing and potential open spaces are situated, and their proximity to aged care facilities.

Aims of the Study

To identify the proximity between urban parks and aged care facilities and whether there is a link between proximity and clusters of older adults (60 years and over) who consider themselves impacted by mobility, or from mental health or physical health issues. The suburbs and towers associated with the inception of a second wave of COVID-19 in Melbourne have demonstrated that the most vulnerable members of our communities are those living close to limited open space.

This paper aims to contribute to two different strands of relevant literature. The first relates to the effect of park and open space proximity to aged care facilities on health. A relatively common finding in this literature is that people living near park areas report being in better physical and mental health and experience lower levels of stress, this is largely attributed to the size of the open space available, cleaner natural environments and better-quality air found in parks [2]. Through facilities, outdoor settings, and services provided, smaller public parks enable people of all ages, socio-economic backgrounds, and ethnicities to obtain these same benefits. Several studies show that that council parks provide opportunities for people to increase their rigorous physical activity, thereby reducing obesity. The literature consistently reveals that those living in close proximity to parks and other recreation facilities have superior physical activity levels, physical and mental health [7, 10, 11, 13, 15, 21, 27].

A second strand of the literature to which the paper contributes investigates the drivers of the COVID-19 pandemic, including the role of crucial factors such as lockdowns, human and economic activity, climate and pollution. On the role of social distance, Greenstone and Nigam [8] find that the mortality benefits of social distancing are about \$8 trillion for the US \$60,000 per US household. Fang et al. [6] analysed the impact of restrictions on human mobility and calculated that without the Wuhan lockdown, contagion cases would have been 64.81% greater in the 347 Chinese cities outside Hubei province, and 52.64% higher in the 16 non- Wuhan cities inside Hubei. Several authors have examined the drivers of Italy's severe COVID-19 outbreak [9, 20, 22, 24] with Ciminelli and Garcia-Mandicó [4] demonstrating that the congestion of the health care system exacerbated the number of deaths in Italy.

These research findings contribute to both research strands by showing that park areas play an important positive role in health outcomes specifically under the context of a pandemic, and that environmental factors impact geographical spread of the disease. In the final part of the paper, we discuss methodological issues, directions for future research and policy implications of our results.

25.2 Urban Parks

Public and private urban parks are critical to the long-term health, liveability and resilience of communities. Access to nature helps individuals to stay physically healthy [16]. Physical activity in nature (e.g. walking, cycling, gardening and other outdoor activities) can lower anxiety [14] and reduce post-traumatic symptoms [19], which might prove to be important after the COVID-19 world-wide social distancing orders are liberalized [1]. Using data from Kansas City, Kaczynski et al. [12] documents having a park within 800 metres from home and the likelihood of having 0, 1, or 2 or more chronic health conditions (CHCs). Rosenfeld et al. [25] reveal that urban parks induce increased physical activities of nearby communities in Dublin, Ireland. Dharmarajan et al. [5] provides evidence of positive mental health outcome due to residing close to parks in Los Angeles. In a recent study, Rice and Pan [23] argue that during these extraordinary circumstances,

urban nature offers resilience for maintaining well-being in urban populations, while enabling social distancing.

In the Australian context, the benefits gleaned from being able to access open spaces and associated walking trails have been demonstrated in Temple Lang [29]. The results of this study strengthen the growing body of evidence that mental health is significantly related to residential distance from parks, with the aged care facility, residents within short walking distance from the park (400 m) and decreasing significantly as the distance increases. The number of visits and physical activity minutes are significantly and independently related to distance.

25.3 Study Area

The study area was the entire CoW municipality, which is one of Melbourne's largest urban municipalities, located about 20 kilometres north of the city and the fastest growing area in the north of Melbourne. The CoW has established urban areas in the south and urban growth areas (new communities) and rural areas in the north. It has been designated as one of six 'growth areas' along the fringes of Melbourne. Between 2016 and 2041, it is projected to grow by 175,000 people in 62,400 additional households. While the population is ageing, it will continue to mainly attract a diverse group of younger families moving to outer areas to establish a home. Some residents are less advantaged than those in other parts of Melbourne and the new suburbs, migration from a wide range of areas across Melbourne means some residents will have fewer community connections. This growth is said to provide significant benefits derived from the critical mass required to make businesses, services, clubs and infrastructure viable. Diversity may provide an interesting culture and the type of vibrancy in which tourism, education, and other activities thrive. However, growth and diversity also make Whittlesea vulnerable to some of the negative effects of emerging challenges such as:

- Increasing demand for infrastructure.
- Changing work patterns.
- Increasing transport issues.
- Climate change.
- Social disconnection.

Suburban development in Whittlesea began after World War 2 and has progressed north since (Figure 25.3). In 2002, an Urban Growth Boundary for Melbourne was put in place that divides Whittlesea's urban and rural areas. There was a lull in new housing development in the late 2000s, but in the last few years, several large subdivisions in previously rural areas, and infill development in the established suburbs, have rapidly increased the number of households.

Despite ageing, the population will continue to be dominated by family households. Whittlesea currently has a markedly younger population than the rest of Melbourne. By 2041, all population groups will grow, but the population will age, with an increased proportion of older people (aged over 55). There will also be an increase in the proportion of the population aged 5 to 19, while those aged 20-54 will decrease. The median age is projected to increase only slightly, from 34 in 2016 to 35 in 2041 (Figure 25.4).

25.4 Methodology

To identify the proximity between urban parks and aged care facilities in CoW and its impact on older adults (60 years and over) who consider themselves impacted by mobility, or from mental

FIGURE 25.1
CoW and Surrounding Area (Northern Melbourne comprises LGAs of Banyule, Darebin, Hume, Moreland, Nillumbik and Whittlesea). Source: SGS Economics and Planning 2018 Data: Victoria State Government 2017, Plan Melbourne

FIGURE 25.2
Figure 2. Extent of Urban Development 1954–2015. Source: SGS Economics and Planning 2018 Data: Victoria State Government 2017, Plan Melbourne

health or physical health issues in this study we conduct an individual survey and a GIS based proximity analysis. The results from both methods are presented in order.

25.4.1 Survey

Analyses of the City of Whittlesea 2019 Household Survey (1,083 respondent households and 3,083 individual respondents) were conducted looking specifically at the results for people who reported being 60 years of age or older [18]. 676 (62%) respondents identified as being over the age of 60 years, 674 respondents indicated their residential location, 2 did not. The distribution of these respondents is presented in Figure 25.4.

FIGURE 25.3
Whittlesea Population Change by Age Group. Source: SGS Economics and Planning 2018 Data: Victoria State Government 2017, Plan Melbourne

FIGURE 25.4
The top five concentrations of respondents aged older than 60 by precinct (in order of highest to lowest) were in the Whittlesea Township (47%), Rural North (37.3), Bundoora (29%), Thomastown (26.9) and Mill Park (22.6)

According to the survey undertaken in CoW, older adults and senior citizens (aged 60 years and over) – respondents were measurably more likely than average to have done less than five hours moderate to vigorous physical activity.

There was measurable and significant variation in the amount of moderate to vigorous physical activity undertaken ‘in the last week’ observed by respondent profile (age structure, gender, and language spoken at home). The following graph provides a summary of the results for respondents doing less than 5 hours last week and those doing five hours or more, as follows:

Of all respondents, 62% answered the questions pertaining to disabilities, within the 60 plus age group, 33.4% of respondents indicated that they had permanent or long-term disability. Ranked in order of highest to lowest, the top three precincts with the highest percentage of people reporting

a disability linked with mobility and/or mental health and/or a medical condition were Epping North, Bundoora and Lalor. On average, in this demographic;

- 2% of total respondents identified mobility as their disability.
- 1% identified mental health as their disability.
- 5% of respondents identified as having a permanent or long-term medical condition.

By precinct, the top three precincts where respondents identified ‘Mobility’ as their disability resided in Lalor (30%), Epping (24%), Mill Park (22%). The top three precincts where respondents identified ‘Mental Health’ as their disability were Mernda (31%), Thomastown (26%), South Morang (21%), followed by Bundoora and Lalor (both 19%). The top three precincts where respondents identified as having a ‘Permanent or long-term medical condition’ were Epping North (86%), Bundoora (69%) and Mill Park (65%).

FIGURE 25.5
Percentage of Self-Reported Disabilities (residents 60+) by Precinct

Figure 25.5 offers distribution of residents self-reporting disabilities and the types of disabilities reported among precincts. For each disability reported, the following rates were the highest among respondents. Four percent (4%) of residents aged over 60 residing in Lalor reported being disabled by ‘Mobility’ issues, 3% of residents aged over 60 residing in Thomastown reported being disabled by ‘Mental Health’ issues and 8% of residents aged over 60 residing in Bundoora reported being disabled by a permanent or long-term medical condition.

Respondents aged over 60 were also asked to self-report whether they undertook vigorous physical activity in the week prior to the survey. The results indicated that those who resided in Mernda and Doreen performed vigorous activity for longer periods than respondents in any other precinct. Interestingly, most residents in Bundoora, Lalor, Thomastown, Epping, Epping North and Mill Park who performed vigorous activity, only did so for less than 2.5hrs over the week.

Figure 25.6 indicates that a high percentage (29%) of residents aged over 60 years reported a need for support (data not shown), and that those in Lalor were in highest need of support for daily tasks, to overcome the limitations of their mobility and to be able to participate in social events.

By precinct, in order of highest to lowest, the top 3 precincts with the highest levels of access

FIGURE 25.6

Type and Percentage of Self-Reported Need for Supports

to or used Aged care services were Lalor (12.6%), Doreen (6.7%) and Bundoora (5.7%). The top 3 precincts with the highest levels of access to or used Mental health services were Epping (9%), and Lalor (8.8%) and Doreen (8.6%). The top 3 precincts with the highest levels of access to, or used Other social services were Bundoora (4.6%), Thomastown (3.9%), and Lalor (3.0%). The data also indicates that between 87.4 and 99 percent of respondents indicated they did not have access to aged care, mental health or other social services, though only two individual respondents specifically identified that distance was a barrier to access.

25.4.2 GIS Based Proximity Analyses

GIS users bring a wealth of knowledge about physical space, particularly geographic space, into the process of interpreting GIS data. The proximity toolset in the analysis ESRI ARCGIS software toolbox can be used to discover proximity relationships. These tools output information with buffer features or tables. Buffers are usually used to delineate protected zones around features or to show areas of influence. For example, one can buffer an aged care facility by one mile and use the buffer to select all the parks that are more than one mile from the park in order to plan for the transportation of aged-care residents to and from their facility to that park. One could also use the multi-ring buffer tool to classify the areas around a feature into near, moderate distance, and long-distance classes for analysis. Buffers are sometimes used to clip data to a given study area, or to exclude features within a critical distance of something from further consideration in an analysis. Buffer and Multiple Ring Buffer create area features at a specified distance (or several specified distances) around the input features. In this research we conducted proximity analysis on multiple ring buffers to identify suitable parks for aged-care residents to visit and completed a gap analysis of aged care facilities and reserves, local parks and smaller urban spaces for the CoW.

Data were collected for parks and Aged care facilities and the distance from each point was calculated. This table can be used for statistical analyses, or it can be joined to one of the feature classes to show the distance to points in the other feature class. Use the Point Distance tool to look at proximity relationships between two sets of things. For example, you might compare the distances between one set of points representing several types of businesses (such as theatres, fast food restaurants, engineering firms, and hardware stores) and another set of points representing the locations of community problems (litter, broken windows, spray-paint graffiti), limiting the search to one mile to look for local relationships. You could join the resulting table to the business

and problem attribute tables and calculate summary statistics for the distances between types of business and problems. You might find a stronger correlation for some pairs than for others and use your results to target the placement of public trash cans, or police patrols [26]. Use Point Distance to find the distance and direction to all the water wells within a given distance of a test well where you identified a contaminant. Below is an example of point distance analysis. Each point in one feature class is given the ID, distance, and direction to the nearest point in another feature class. proximity findings are incorporated to make the framework more relevant to the users of Geographic Information Systems (GIS) concerning their spatial circumstances.

Urban parks, along with other natural elements like conservation reserves and waterways are a key mechanism that will enable the CoW to cope with future urban challenges linked to densification. They will also make the community more resilient to human health, wellbeing and environmental challenges such as heatwaves, flooding and soil contamination. A park hierarchy groups parks into distinct types and defines how each type of park is used, what it contains, and what service levels are associated with them. The hierarchy and naming conventions adopted by CoW, park types include:

Figure 25.7 present number of parks near aged care facilities identified at 100 metres apart. While only nine (9) aged care facilities were located within 100 metres of a nearby park, 125 aged care facilities were within 800 metres. For a person living in an aged-care facility, walking a distance of 800 meters could prove to be a demotivating factor; whether many of them would have enough energy to cover those distances unsupported is also unknown.

TABLE 25.1
Distance between Parks and Aged Care Facilities in CoW

Distance from aged care 100 m interval	100 metres	200 metres	300 metres	400 metres	500 metres	600 metres	800 metres	Grand Total
Civic & Commercial Facilities			5	4	3	3	4	19
Conservation Area	1	1		2	4	3	10	21
Landscape Site	2	8	14	17	19	33	43	136
Major Community Parks				1	1	1	1	4
Municipal Open Space		5	7	9	8	11	12	52
Neighbourhood & Local Open Space	6	18	29	30	40	40	55	218
Special Purpose Site					1			1
Grand Total	9	32	55	63	76	91	125	451

From Figure 25.8a we can easily understand that most of the aged care facilities (marked as a solid black circle) are located in the lower section of the map, while most of the larger conservation areas, open space and landscape sites are located in the top right section of the lower half, too far away to access. Even some of the neighbourhood and municipal open spaces, and major community parks are quite distant from aged care facilities.

In Figure 25.8b while the aged care facilities in this map are comparatively small, a lot of them are quite distant from conservation areas, landscape sites, and major community parks which are often the most equipped to service the needs of senior citizens and those who live in aged-care facilities.

Park and recreation professionals are seeking answers to key questions as they move into a response and prevention mode in the coming days and weeks, especially in communities that are starting to document confirmed cases of COVID-19 (Figure 25.9). As part of hazard identification and mitigation process, it is important to identify any parks near aged care facilities, to provide adequate communication to affected residents when closing or cleaning these facilities or providing advice on the nearest open space at which residents may find natural respite.

The numbers of confirmed coronavirus cases on 12 July are:

FIGURE 25.7
Proximity of Parks to Aged Care Facilities

FIGURE 25.8
(a) Proximity of Parks to Aged Care Facilities (b) Proximity analysis parks in close to aged care facilities

- **In Australia:** 9797 cases – 7728 recovered (108 deaths)
- **In Victoria:** 3967 cases – 2329 recovered (24 death)
- **In Whittlesea:** 33 cases (including 2 active cases)

Community transmissions of second wave started to spread across Victorian aged care families.

FIGURE 25.9
Daily change coronavirus cases from April to July

As of July 14, 2020, a total of 14 residents and 17 staff at the Menarock Life Essendon aged care facility in Essendon have tested positive to coronavirus, the largest cluster in the state. In this backdrop while planning for location choice for aged care facilities or parks two major criteria should be proximity of recreational facilities to aged care facilities as well as the design of these facilities to ensure social distancing while people are using these facilities.

FIGURE 25.10
Age care distance from 1 km to 10 km

25.5 Results Discussion and Limitations

The proximity analysis indicates that aged care facilities are clustered in the south west and west of the municipality and that these centres are in closer proximity to parks. It also reveals that in the northeast (newly developed areas) aged care facilities have not been collocated with parks. The model also reveals that the distribution of Aged care facilities is less dense in the newly developed areas in comparison to older suburbs like Epping, South Morang, Whittlesea, and Lalor. The demographic analysis shows that in order of highest to lowest, the top three precincts consisting of residents who reported they were living with a disability were Epping North, Bundoora and Lalor.

By analysing the impact of multiple demographic factors such as the methodology used herein, information can be gleaned to determine the spatial location of those in most need. Our data analysis shows that residents over the age of 60 who resided in Lalor needed the most support. Lalor had the highest number of people reporting they experienced limitations due to mobility and needed the most support with daily tasks and to overcome limitations they faced when trying to socially participate. Interestingly, the precinct of Lalor also recorded the most respondents to use and have access to aged care facilities and the lowest rate (87.4%) of respondents who indicated they needed the services but could not access them. These results do not directly correlate with the proximity analysis because there were no aged care facilities located in Lalor.

A nearby urban park has been associated with the same mental health benefits as decreasing local unemployment rates by 2 percentage points, suggesting at least the potential for environmental interventions to improve mental health [28]. There are limitations to the application of the proximity analysis we have conducted. It is cross-sectional, making it impossible to control for important confounders, including residential selection, and assumes that the park needs to be in proximity of an Aged-care facility to be utilised by its occupants. The analysis does not provide an evaluation of the impact of the quality, location or suitability of park infrastructure such as seats, barbecues, walking or cycling paths for older people. Another limitation of the study is that it has not evaluated the impact of the modes of transport that would be utilised by residents of Aged-care centres or their carers to facilitate park visitation. Similarly, other than to locate them within a spatial precinct, the survey data does not identify the spatial location of the resident who filled in the survey. This is critical because the likelihood of a person in an aged care facility completing the household survey would be very low; it is complex and requires a certain level of cognitive ability to complete. It could be argued that the survey results reflect more about the composition of households and that specific surveys of residents living in aged care facilities focusing on their interaction with nearby open space within these precincts is required to understand the effect of the proximity to open space on the mental health of residents therein.

Implications for planning and open space policy makers

Mental health policy has traditionally focused on interventions required to cure an illness at an individual scale, such as providing clinical support or improving access to services for sufferers in need of support. It is our contention that mental health policy should shift its focus from curing the individual to prevention by maximising the benefits of environmental determinants such that both the most vulnerable and the broader population may benefit substantially from such measures.

25.6 Conclusions

The paper set out to explore the importance of several parks and the spatial relationship between park availability and COVID-19 across age groups in the CoW. Park-based physical activity is a promising means to satisfy current physical activity requirements for COVID-19 time. However, there is little research concerning what park environmental and policy characteristics might enhance

physical activity levels. This paper analysis and proposes a spatial model to guide thinking and suggest hypotheses. This paper also describes the relationships between park benefits, park use, and physical activity, and the antecedents/correlates of park use.

This paper suggests that in councils policies regarding spatial design, the provision of park space close to residential areas aged care facility and should be considered so that individuals can engage in activities such as walking and exercise [3]. As indicated through our analyses as well as some earlier studies, having a well-designed landscape planning with proximity between aged care and recreational facilities help develop an agile and resilient community ready to physically and mentally cope up with unprecedented events like COVID-19 pandemic. In future research will discuss classification scheme, the discussion focuses on park environmental characteristics that could be related to physical activity, including park features, condition, access, aesthetics, safety, and least cost path analysis and policies. Data for these categories should be collected within specific geographic areas in or around the park, including activity areas, supporting areas, the overall park, and the surrounding neighbourhood. Future research also focuses on how to operationalize specific measures and methodologies for collecting data, as well as measuring associations between individual physical activity levels and specific park characteristics. Collaboration among many disciplines is needed.

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