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Where Will Older Adults Reside: Understanding the Distribution of Naturally Occurring Retirement Communities in Australia

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Abstract: Most older individuals prefer to age in place during their later years; however, achieving this aspiration presents significant challenges. Naturally Occurring Retirement Communities (NORCs) represent a potential option for promoting healthy aging, both from the perspective of meeting seniors' real needs and cost-effectiveness. This article aims to analyze the distribution of NORCs in Australia and compares census data from 2011 to 2021 to understand the overall distribution patterns and changes across the nation, by providing a localized analysis of the hotspot distribution of NORCs in eight Greater Capital Cities. The study employs methods of geovisualization, Global Moran's I, and Getis-Ord Gi* analysis to examine the spatial correlations and clustering effects of NORCs. The results indicate that NORCs are rapidly growing in Australia, with their distribution primarily influenced by sea change and urbanization. Understanding the trends in NORC distribution can assist the government in developing effective and localized policies and interventions to help older Australians to better age in place.

Keywords: Naturally Occurring Retirement Communities (NORCs); older individuals; Global Moran's I; NORC distributions; healthy aging; aging in place; community; government; Greater Capital Cities; Australia



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1. Introduction

Global aging is a pronounced trend, driven by decreasing fertility rates and increasing life expectancies worldwide. By the annum 2022, the proportion of the global population aged 65 and over reached 10% of the global population aggregate [1]. According to the United Nations Population Fund's "World Population Prospects 2019" report, by 2050, this demographic segment is projected to constitute 16% of the world's population, which translates to roughly one-sixth [2].

In Australia, the proportion of the population aged 65 and over has reached 17% in 2022 [1]. Along with the evolving of the demographic landscape, the majority of older individuals prefer to undergo 'aging in place'—a term that encapsulates the desire to continue residing within one's own home or within a familiar community setting, rather than transitioning to an institutional facility [3]. This trend toward aging in place is not only driven by individual preferences; it is also seen by governments as a cost-effective alternative to institutionalized care [4]. Apart from economic implications, the aging in place approach yields a multitude of health benefits, reinforcing the older individual's independence and self-governance. Consequently, this foundational support substantially uplifts their life quality in advanced age, engendering a more healthful and gratifying experience of aging [5].

In 1985, M. E. Hunt [6] at the University of Wisconsin introduced the concept of Naturally Occurring Retirement Communities (NORCs), referring to those communities that

evolve over time to predominantly house older adults, despite not being initially designed for them. Hunt characterized NORCs as communities where at least 50% the residents are 60 years or older, offering older individuals to actively choose rather than passively adapt, essentially matching the goal of aging in place. This arrangement supports older people's desires to remain in known environments, enhances their social participation, vitality, and satisfaction, while reducing psychological disorders like depression and improving physical health. Lanspery and Callahan define a NORC as a census block group where at least 40% of the households are headed by individuals aged 65 or older, and there are at least 200 households in total within this census block group [7]. Rivera-Hernandez and Yamashita conceptualize NORCs as regions where at least 40% of both homeowners and renters are aged 65 years and older [8]. Lawler mentions that in census tracts where 25% of the population is aged 65 or older, these communities can be considered NORCs and may warrant the provision of targeted comprehensive services [9].

In addressing the concept of "older people", research conducted by Sarah Abdi et al. projects that nearly 50% of the population aged 65 and above in the UK will experience physical or mental health limitations for the remainder of their lives, thereby increasing their need for care and support [10]. Additionally, Feliciano Villar et al.'s research mentions defining older adults as those aged 60 and above [11]. In Australia, older people are typically defined as those aged 65 and over [12]; therefore, this paper uses 65 years as the starting age of older people.

In the United States, Rivera-Hernandez et al. utilized Geographic Information Systems (GIS) to track the spatial and temporal shifts of NORCs in Ohio over a decade [8]. Based on census data from 2000 to 2010, maps were created and analyzed using U.S. census tracts, with each tract representing approximately 4000 residents (ranging from 1200 to 8000) [8]. Due to differences in census unit sizes across countries, Vincent G. DePaul et al. in Canada used Dissemination Areas (DAs) as the unit of analysis, with each area comprising 400 to 700 individuals [13]. The smaller clusters allow for more precise identification of NORCs. This study utilizes data from the Australian Bureau of Statistics (ABS), employing census data from 2011 to 2021. The analysis is conducted using SA1 units, each containing 200 to 800 individuals, to investigate the geographic distribution of NORCs across Australia. Compared with the relevant studies in the United States and Canada, which primarily focus on the local identification and analysis of NORCs, this research defines and examines NORCs from a nationwide perspective. This approach not only provides a comprehensive overview of their distribution but also considers representative local characteristics.

Drawing from census information provided by the Australian Bureau of Statistics, E and Xia [14] have proposed an adaptation of the NORC concept tailored to the Australian context, characterized by communities where at least 40% of the aging people are aged 65 and above. Through spatial analytical methods and the strategic use of visualization techniques, E and Xia have mapped out the spatial distribution, temporal evolution, and locational attributes of NORCs within the Greater Brisbane area of Australia [15]. NORCs are expected to continue their rapid expansion in the future, necessitating governmental action through policies and measures to support NORCs. This support is designed to enhance the wellbeing of older individuals and their families, thereby fostering healthy aging [16].

Although the research findings of E, Xia, et al. provide a comprehensive analysis of NORCs within the Brisbane area [14–16], delineating critical characteristics and trends in the formation and development of the older people communities in this region, it is important to acknowledge the vast diversity in geographical, cultural, and socio-economic conditions across Australia. Consequently, the insights derived from Brisbane may not be entirely applicable to other regions within the country. To gain a holistic understanding of the NORC phenomenon in Australia and to develop effective policies and interventions, it is imperative to conduct comparative analyses of NORC characteristics across various regions.

Subsequent research should contemplate extending its scope to other major urban centers and remote areas within Australia, including, but not limited to, Sydney, Melbourne, Adelaide, Perth, and rural regions. Such cross-regional comparative studies would reveal how variables such as urban scale, geographical location, and socio-economic conditions influence the formation and evolution of NORCs. By broadening the research scope to encompass the entirety of Australia and utilizing a decade of ABS Census data (between 2011 and 2021), this study aims not only to enhance the understanding of the complexities and diversities inherent in NORCs but also to provide policymakers and community planners with more precise and specific guidance to promote the living conditions and welfare of older adults in Australia.

Therefore, this research is dedicated to conducting a geographic analysis of NORC distributions based on the most recent census data from 2021 and investigating the expansion of NORCs over the previous decade. The objectives of this study are outlined as follows:

1. Characterize and delineate the geolocations of NORCs across Australia (including the eight Greater Capital Cities);
2. Analyze the development and transformations of Australian NORCs over the decades;
3. Predict future trends in NORC evolution and identify potential sites for emerging NORCs in Australia.

As the proportion of the older population increases in Australia, particularly in its major cities, it is important to note that NORCs, although not officially recognized, are indeed a factual social phenomenon and have a great potential to support older people. Understanding and supporting the development of NORCs is crucial for Australia to better address the challenges of aging and to enhance the welfare and quality of life of older people. Given the limited knowledge about the formation and evolution of NORCs, this paper explores the spatial and temporal changes in NORCs over the past decade. It examines the residential preferences of the aging population and identifies patterns from historical developments to predict future trends of NORCs. This research aims to assist policymakers and community planners in preparing for and responding to the forthcoming challenges.

2. Materials and Methods

Every five years, the Population and Housing Census is conducted across Australia by the Australian Bureau of Statistics (ABS), recording all individuals and households. Before 2011, the primary data collection unit was the Census Collection District (CD) [17]. However, from the 2011 Census onward, the ABS has utilized Mesh Blocks as the basic unit, aggregating data to Statistical Area Level 1 (SA1) units for the 2011, 2016, and 2021 censuses. The Australian census is conducted every five years, with the most recent one completed in 2021, and the next scheduled for 2026. The SA1 units are structured to optimize the geographic granularity provided by the Population and Housing Census data, ensuring that the smallest units of measurement maintain a sufficient number of residents. In 2021, there were 61,845 SA1 regions covering the entirety of Australia, with no gaps or overlaps [18]. This includes 34 non-spatial special purpose codes (not included in the analysis). SA1 units, averaging around 400 residents, are established as baseline units for analyzing community or neighborhood characteristics, focusing on older demographics. NORCs are defined by the proportion of older household members within these units [14].

Figure 1 presents an administrative map of Australia, delineating the principal Greater Capital regions along with the eight states and territories. It provides data on the total population, the older population aged 65 and over, their proportion within the total demographic, and the population figures for the Greater Capital areas. Additionally, the diagram provides the median ages for these capital cities, identifying the three regions with the highest median ages. The total population of Australia's eight capital cities reaches 17,019,956, making up 66.9% of the country's overall population. The national median age is 38.4 years. Among the capitals, Darwin has the lowest median age at 34.5 years, followed by Canberra at 35.4 years. In contrast, Adelaide has the highest median age of any capital

city at 39.3 years, with Hobart close behind at 38.6 years, based on data from Statistical Area Level 2 [19]. The locales with the highest median ages include Hawks Nest (65.5 years) and Tuncurry (62.3 years) in New South Wales, along with Bribie Island (62.7 years) in Queensland, all of which are popular coastal retirement destinations.

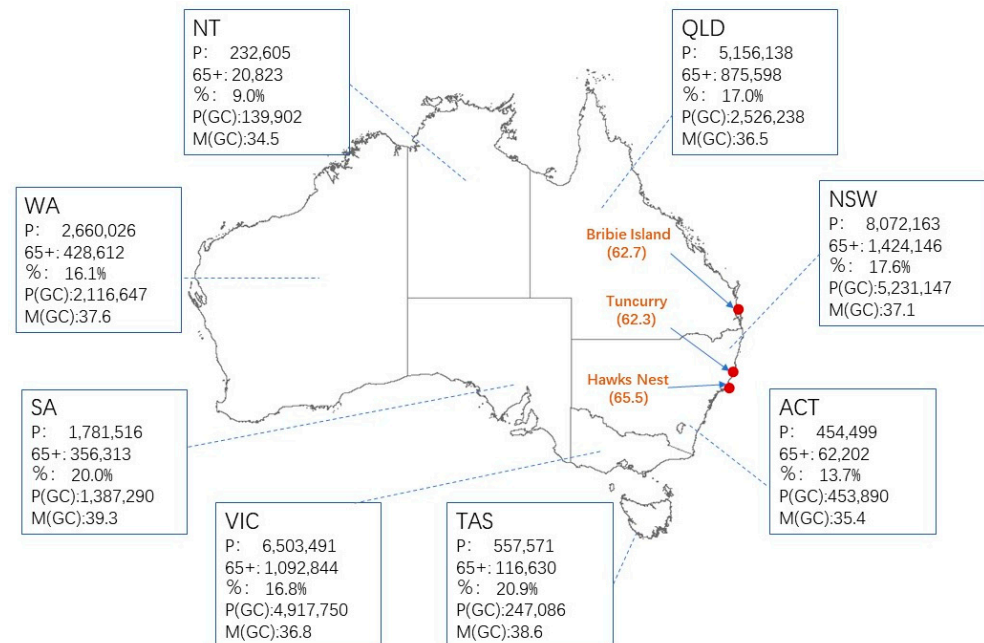


Figure 1. Map of Australia from the 2021 Census, displaying total population ‘P’, older demographic ‘65+’, their population percentage ‘%’, Greater Capital regions’ population ‘P(GC)’, and median ages ‘M(GC)’.

Using Geographic Information Systems (GIS) and employing spatial–temporal data analysis techniques such as spatial autocorrelation and hotspot/coldspot analysis, this study compares the latest 2021 Australian Census data with data from 2011 to 2016, based on the geographic boundaries and features identified in the census, to elucidate the evolving geographical patterns of NORCs over time.

In this study, the designation NORC is specifically used for communities where at least 40% of the members in households are 65 years old and above, explicitly excluding holiday tourists and residents of nursing homes [14]. Based on this criterion, the study selects SA1 units and analyzes the percentage of older residents for spatial analysis, aiming to clarify the distribution patterns of the older population across Australia. This investigation employs three spatial analytical methodologies to delve into the genesis and evolution of NORCs, conducting both global and local analyses. The study utilizes geovisualization [20] to discern the overarching spatial patterns across extensive areas. Within the context of geovisualization and spatial analysis, “global analysis” and “local analysis” represent two distinct scopes of examination. Global analysis, exemplified by the application of Global Moran’s I [21], scrutinizes spatial patterns or relationships across the entirety of the study area, offering a comprehensive overview. Conversely, local analysis, as illustrated by the utilization of the Getis-Ord G_i^* statistic [22,23], concentrates on specific segments within the research domain to discern localized patterns or phenomena, such as hotspots or coldspots, which may remain obscured in a global perspective. Spatial analysis techniques are commonly utilized in research related to aging and healthcare [24,25]. The analytical tool employed for this purpose is ArcMap version 10.8.2.

Global Moran’s I quantifies spatial autocorrelation, indicating how spatial patterns differ from randomness. Global autocorrelation is often used to measure the spatial autocorrelation of an entire spatial distribution, that is, how the attribute value of a location is

influenced by the attribute values of other locations. A commonly used measure of global autocorrelation is the Moran's I index, which is defined by the formula

$$I = \frac{N}{\sum_i \sum_j w_{ij}} \times \frac{\sum_i \sum_j w_{ij} (X_i - \bar{X})(X_j - \bar{X})}{\sum_i (X_i - \bar{X})^2}$$

where

N is the number of observations;

X_i and X_j are the attribute values for spatial units i and j ;

$\bar{X}$ is the mean of all observed values;

w_{ij} is the spatial weight between units i and j in the spatial weight matrix, indicating their spatial proximity.

Global Moran's I values range from -1 to $+1$, where -1 indicates perfect dispersion or negative spatial autocorrelation, $+1$ represents perfect clustering or positive spatial autocorrelation, and values near 0 suggest random spatial patterns [26]. Positive values indicate that similar values tend to be closer together, whereas negative values suggest that similar values tend to be dispersed.

The Z distribution of global autocorrelation, especially for the Moran's I statistic, is useful for evaluating the significance of spatial autocorrelation. By calculating Z , we can determine whether the Moran's I statistic significantly deviates from its expected value under the assumption of a random distribution. A large absolute value of Z (e.g., greater than 1.96 , which corresponds to a specific confidence level) suggests that the observed spatial autocorrelation is significant and unlikely to be a result of random chance. The formula for the distribution of Moran's I is as follows:

$$Z(I) = \frac{I - E[I]}{\sqrt{\text{Var}[I]}}$$

where

$Z(I)$ is the standardized Z score of the Moran's I statistic;

I is the actual computed value of Moran's I;

$E[I]$ is the expected value of Moran's I, which under the assumption of random distribution is often close to $-\frac{1}{N-1}$, where N is the number of observations;

$\text{Var}[I]$ is the variance of Moran's I.

The Getis-Ord G_i^* statistic, derived from the Local Moran's I statistic, serves as a local measure of spatial autocorrelation, pinpointing local spatial clusters within a specified area, such as hotspots (clusters of high values) and coldspots (clusters of low values). This statistic is utilized to analyze the spatial distribution patterns of data within localized areas, uncovering the similarity or heterogeneity of spatial data within these regions. The formula for the G_i^* statistic is as follows:

$$G_i^*(d) = \frac{\sum_{j=1}^n w_{ij}(d)x_j - \bar{X} \sum_{j=1}^n w_{ij}(d)}{\sqrt{\frac{S^2 \sum_{j=1}^n w_{ij}^2(d) - \left(\sum_{j=1}^n w_{ij}(d)\right)^2}{n-1}}}$$

where

x_j is the attribute value at location j ;

$w_{ij}(d)$ is a distance weight function representing the spatial weight between locations i and j , typically dependent on their distance d ;

$\bar{X}$ is the mean of attribute values across all locations;

S^2 is the variance of attribute values across all locations.

The index evaluates whether a given location i is a statistically significant spatial hotspot or coldspot by considering the attribute values of the location and its neighbors. If the G_i^* value is significantly greater than zero, location i is considered a hotspot area; if G_i^* is significantly less than zero, it is considered a coldspot area.

Point density analysis aims to calculate the density value for each cell based on the number of points within a certain range (in ArcGIS). For each cell in the analysis area (usually a raster cell), point density analysis counts the number of points within a specified search radius and converts this count into a density value. This density value is typically calculated based on the number of points divided by the area within the search radius, i.e.,

$$\text{Point Density} = \frac{\text{Number of Points}}{\text{Area within Search Radius}}$$

The area within the search radius can be circular or another shape, depending on the specific analysis settings.

3. Results

According to data from the Australian Bureau of Statistics, the population of Australia was recorded at 21.5 million in 2011 [27]. This figure experienced an increase of 8.8%, rising to 23.4 million by 2016 [28]. By 2021, the total population reached 25.42 million, which represents an 8.6% growth from 2016 [29]. During this period, the population aged 65 and over increased from approximately 3.01 million in 2011 to 3.67 million in 2016, reflecting a growth rate of 22%. By 2021, the older population reached about 4.37 million, representing a 19% increase from 2016.

Figure 2, utilizing SA1 unit data, demonstrates a significant growth in the aged demographic within Australia's census figures. Analysis of data from the past decade reveals a demographic shift in the population aged 65 and over, with a significant increase along the eastern, southern, and southwestern coastal areas. New South Wales has the highest population of individuals aged 65 and over. In 2011, there were 1,018,178 people, which increased to 1,424,146 by 2021, with the proportion of the population rising from 14.7% to 17.6%. In Victoria, the population aged 65 and over grew from 761,578 in 2011 to 1,092,844 in 2021, with the percentage increasing from 14.2% to 16.8%. Meanwhile, the proportion in Queensland also rose from 13.1% to 17%. Tasmania has become the oldest state in Australia, with the proportion of the older population rising from 16.3% in 2011 to 20.9% in 2021, where one out of every five people is aged 65 or above.

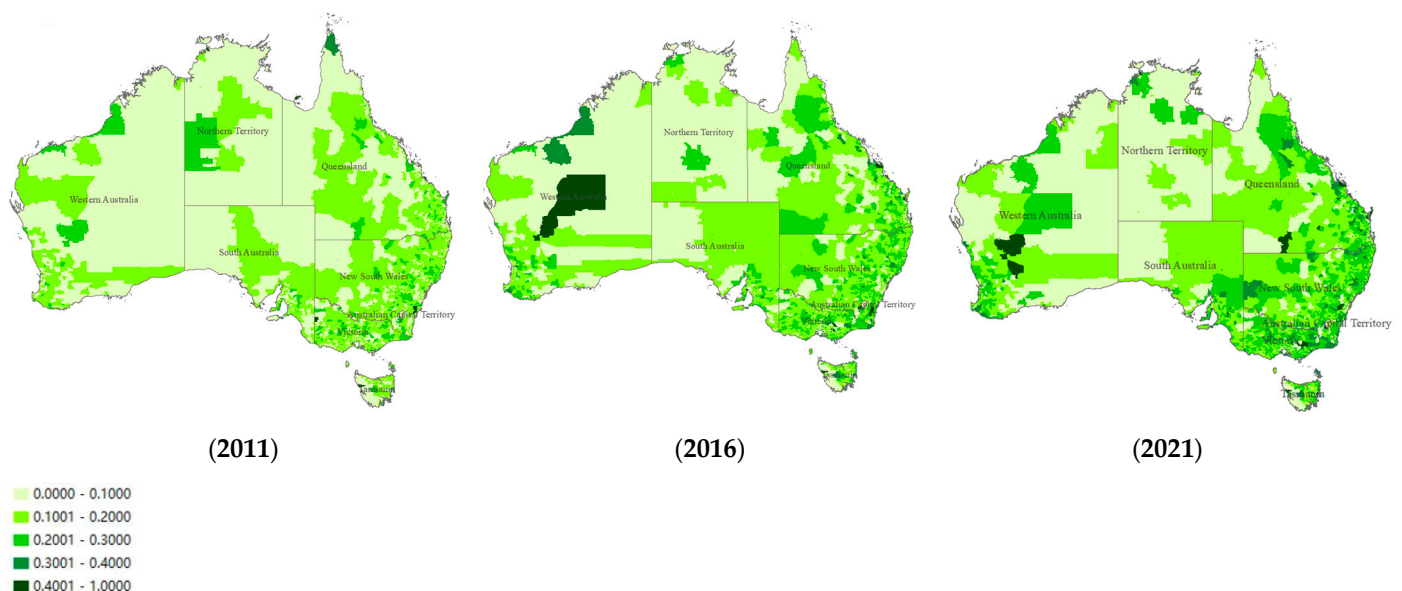


Figure 2. Map of older individuals (aged 65 and over) distribution across Australian SA1 level: 2011, 2016, and 2021, with percentage indicators.

It is noteworthy that in the Meekatharra region of Central Western Australia, the percentage of older individuals witnessed an inverse fluctuation between 2011 and 2021. This unit, covering a large area with a relatively small total population, is highly sensitive

to shifts in the demographic. Over this decade, there was a pronounced decline in the total population from 74 in 2011 to 29 in 2016, slightly rising to 34 in 2021, with the count of household members aged 65 and above at 4, 12, and 8, respectively. Despite its visual prominence, this phenomenon does not possess generality or representativeness.

Figure 3 delineates the geographical distribution of NORCs within Australia for the years 2011, 2016, and 2021. The definition of NORCs is informed by previous research conducted by E, Xia, et al. [14–16]. Initially, in 2011, among 54,806 census units, 727 (or 1.3%) were identified as NORCs, with these communities accounting for 132,167 of the 3,012,291 older individuals aged 65 and above (4.4%). By 2016, from 57,524 units, 1099 (1.9%) were recognized as NORCs, incorporating 194,427 of the 3,676,768 older individuals (5.3%). By 2021, out of 61,845 units, 1659 (2.7%) were identified as NORCs, encompassing 299,289 of the 4,378,086 older individuals (5.3%). Over the decade, both the absolute count and the proportional representation of NORCs within the census units experienced a twofold increase.

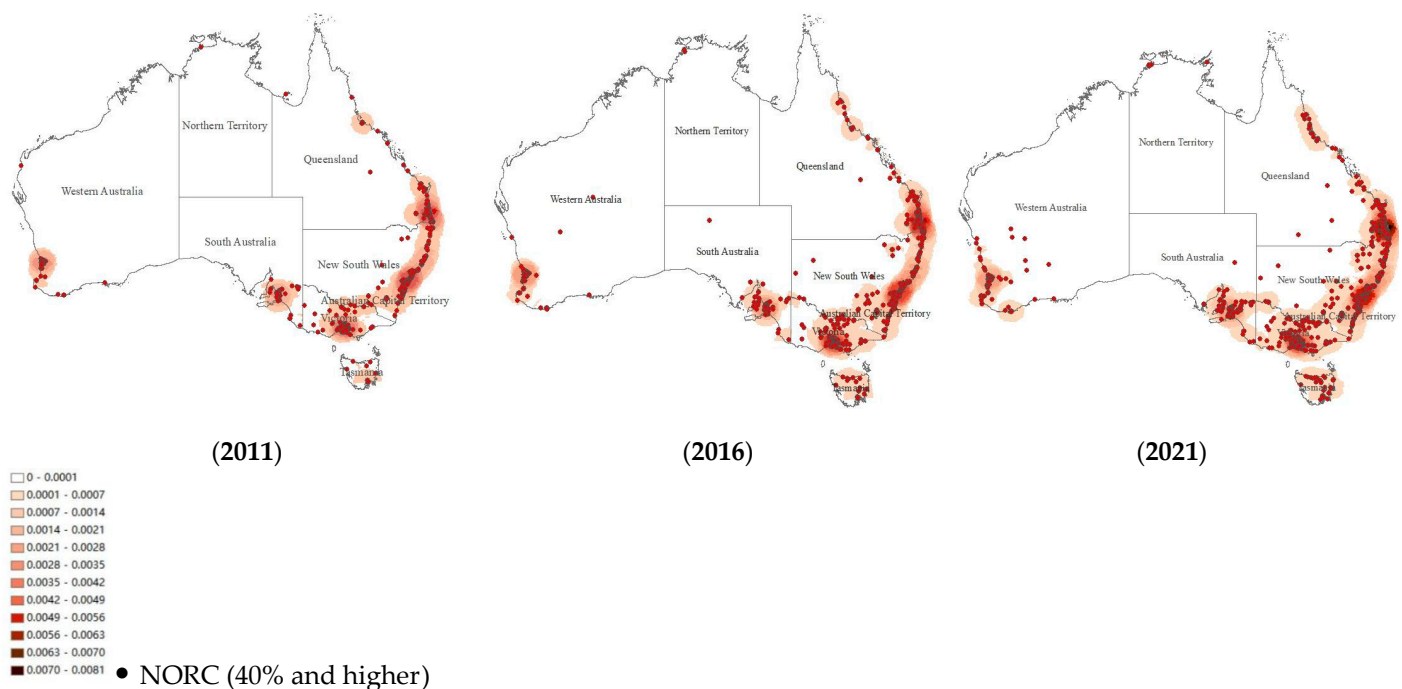


Figure 3. Map of NORC distributions in Australia for 2011, 2016, and 2021, alongside point density.

As shown in Figure 3, regions identified as NORCs predominantly occupy coastal and capital city locales. Within this context, New South Wales contained 572 NORCs in 2021, constituting 34.5% of the annual aggregate, while Queensland contributed 418, representing 25.2%, Victoria contained 301 NORCs, accounting for 18.1% of the total. An examination of the data over a decade reveals that the regions experiencing the most rapid growth in NORCs were the Northern Territory, Tasmania, and the Australian Capital Territory, all of which saw their numbers more than double. This phenomenon arises because regions with smaller population bases are more sensitive to fluctuations in the percentage of older residents.

Utilizing the Global Moran's I statistic to assess the spatial clustering of NORCs, the value of Moran I was 0.09906 ($p = 0$, $z = 11.647587$) for the year 2021. This figure suggests a pronounced tendency for NORCs, or census areas with a higher proportion of older people aged 65 and above, to be geographically concentrated. This pattern of aggregation implies that areas are not randomly dispersed but rather are situated in close proximity.

Following the macro-analysis of NORCs across Australia, as shown in Figure 4, this paper delves deeper into a meticulous examination of NORCs within Australia's eight Greater Capital Cities. This detailed analysis, grounded in an understanding of regional

characteristics and disparities, aims to capture the unique NORC distributions of each representative city. According to the 2021 Census, the combined population of these eight capitals encompasses 17 million people (66.9% of the total). Among them, there are approximately 2.2 million household members aged 65 and above; they account for 60.1% of the total sample of older household members. As economic and cultural hubs, cities like Greater Sydney, Greater Melbourne, Greater Brisbane, Greater Perth, Greater Adelaide, Greater Hobart, the Australian Capital Territory, and Greater Darwin play pivotal roles in Australia's aging trajectory, each presenting distinct age community forms and traits. We aim to uncover the finer details about aging trends, offering data support for crafting precise and formulating local policies and interventions. This step not only enriches our initially broad analysis but is crucial for deepening our comprehension of the complexities within Australian NORCs.

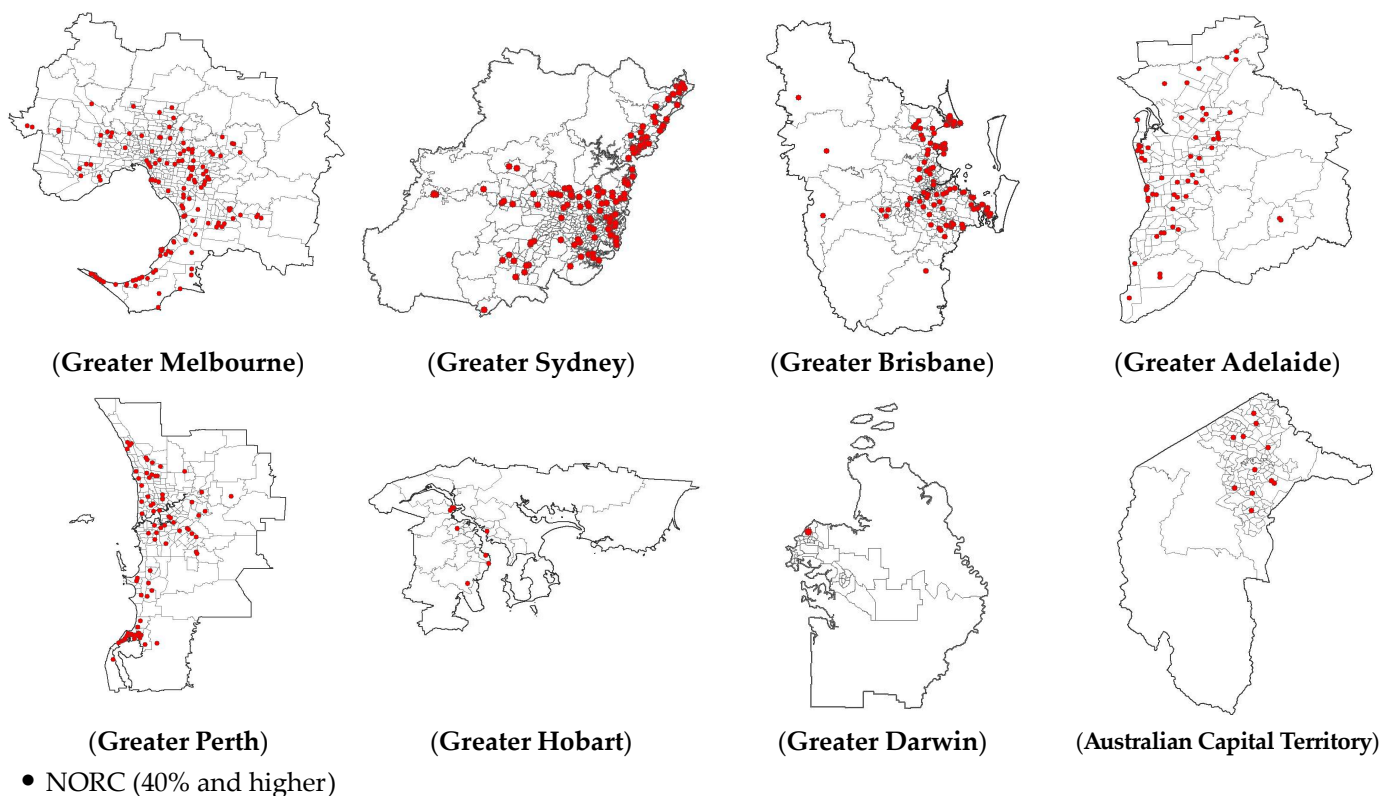


Figure 4. Map of the distribution of NORCs in Australia's eight Greater Capital Cities, 2021.

In the Greater Sydney region, NORCs are predominantly found along coastal areas, especially in the Central Coast, Northern Beaches, and Eastern Suburbs. The Greater Sydney region has the highest number of NORCs among the eight Greater capitals, with 181 SA1 units identified, covering over 666,236 household members aged 65 and above. Meanwhile, Greater Melbourne's NORCs mainly cluster around the inner bay areas, extending inland, with 166 SA1 units defined as NORCs, encompassing around 617,854 household members aged 65 and above. As the third largest city, Greater Brisbane's NORCs are notably concentrated along its coastal regions and the Brisbane River, with 165 NORC units identified covering about 311,377 older individuals.

In Greater Adelaide, Hobart, and Perth, NORCs are strategically located near coasts and rivers, reflecting the living preferences of older individuals. Specifically, Adelaide's NORCs are along the coasts to the north, south, and west, totaling 62 units. Hobart's 10 NORCs are near the Derwent River and Perth's 103 NORCs are mainly in the western part of the city. The household members aged 65 and above in these NORCs are 220,115 in Adelaide, 39,193 in Hobart, and 280,245 in Perth.

In 2021, within Greater Darwin, four SA1 units were classified as NORCs, notably including the Tiwi region. Following the same criterion, E. Xia's previous research [14], which requires a minimum of 200 individuals in each sample unit for inclusion in the map, other regions with smaller populations were excluded from the visual depiction in order to reduce the impact of sensitive cells on the overall analysis. The Greater Capital Area had 15 NORCs, predominantly located within the Canberra region, accommodating 51,646 individuals aged 65 and above.

As shown in Figure 5, the Getis-Ord G_i^* statistics reveal areas of significant concentration within the eight Greater Capital Cities, whether of high activity (hotspots) or low activity (coldspots), providing a nuanced understanding of the urban aging landscape. Within the Greater Melbourne region, hotspots predominantly concentrate around the urban core and the Mornington Peninsula. In contrast, coldspot regions principally align with the CBD/Southbank vicinity and the suburban areas proximate to the northern airport. In the Greater Sydney region, the hotspots predominantly lie along the coastal zones, notably in the Central Coast, Northern Beaches, and Eastern Suburbs, and the coldspots are primarily found in the city and inner south, Parramatta, and the Blacktown area. In the Greater Brisbane region, hotspots primarily line the coast, while the southern suburbs and the Logan region are largely marked by coldspots. In the Greater Adelaide region, hotspots envelop the periphery of the city, with the older individuals notably concentrated in the eastern suburbs and Holdfast Bay, whereas

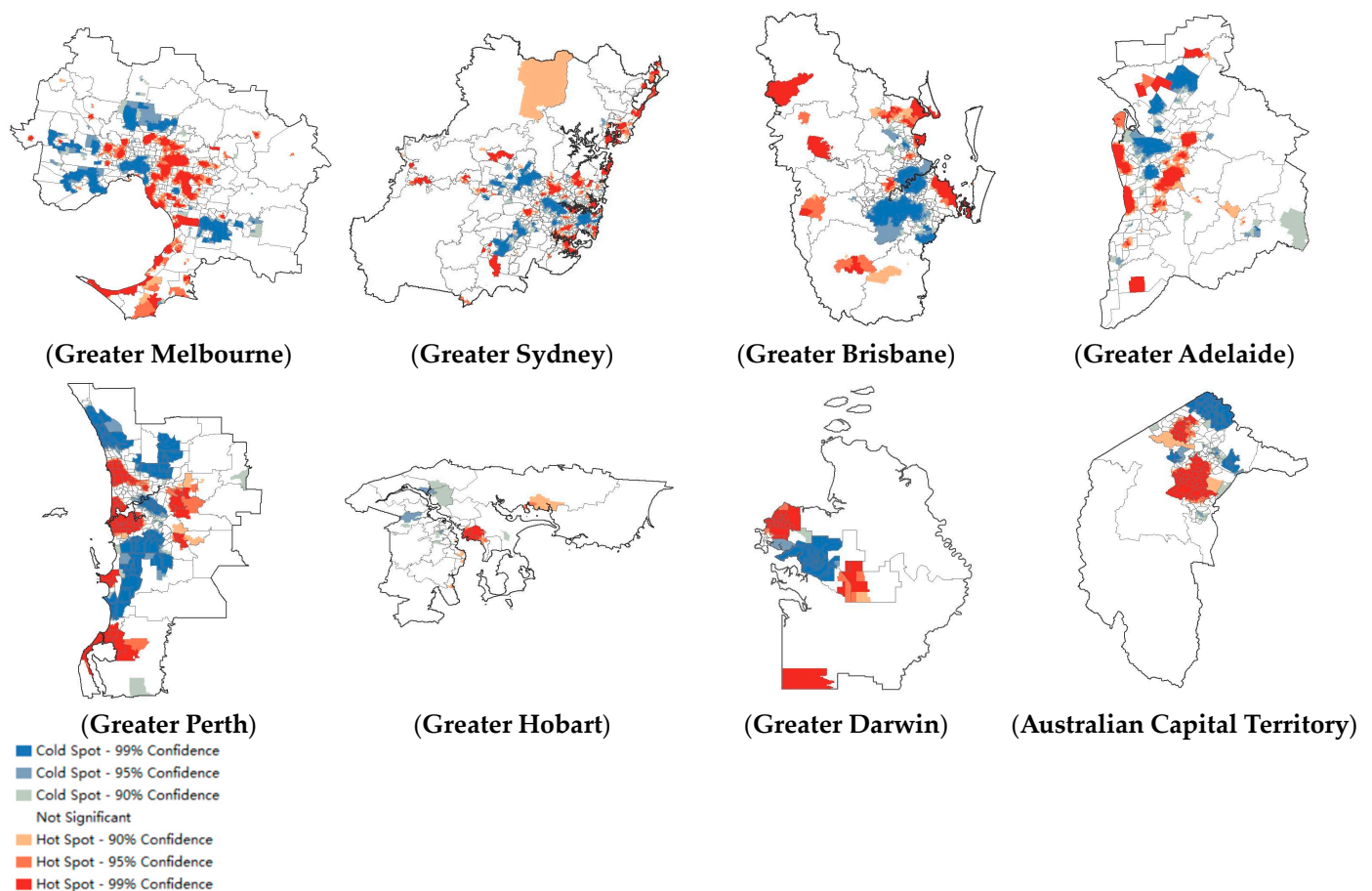


Figure 5. 2021 analysis of optimal hotspots based on older household membership (aged 65 and over) across Australia's eight Greater Capital Cities.

In the Greater Perth region, hotspots predominantly cluster around coastal suburbs such as Matilda Bay and City Beach, as well as the Mandurah area. Conversely, the coldspots are more pronounced in areas like Kwinana, Cockburn, Swan, and Warnbro. Meanwhile, in Greater Adelaide, hotspots envelop the periphery of the city, with the older individuals notably concentrated in the eastern suburbs and Holdfast Bay, whereas

coldspots emerge within the city's core and northern suburbs. In Greater Hobart, the focus shifts to the Derwent River region for hotspots, with coldspots being less distinctly defined.

In the Greater Darwin, hotspots are predominantly found in the Darwin Suburbs, whereas coldspots are mainly located in the Palmerston region. In the Australian Capital Territory, hotspots are mainly concentrated in areas both south and north of Canberra's city center, while the coldspots are primarily located in the northern suburbs.

4. Discussion

Utilizing the census data from the Australian Bureau of Statistics, a comparative analysis of NORC distribution patterns across the three census periods from 2011 to 2021 indicates a consistent and marked increase in NORCs across Australia. In particular, the quantity of NORCs increased by 128.2% between 2011 and 2021. This significant growth in NORCs is largely attributed to the migration behaviors of this demographic, with sea change being one of the primary reasons. They seek environments that support aging, rather than just the natural aging of existing community members or the migration of younger people away from these areas [8,30]. Climatic environmental factors also play a significant role in shaping the distribution of these areas with high concentrations of older household members. According to data from the National Map of the Australian Government [31], older household members are primarily domiciled in areas with an annual average daily solar exposure of 18–21 MJ/m² and 15–18 MJ/m². Research evidence supports the positive effects of sunlight on the human immune system, cardiovascular health, and certain types of cancer [32], with lower levels of solar radiation being associated with an increased incidence rate of cognitive impairment [33]. Meanwhile, the proportion of older adults tends to correlate with urbanization levels in a region, as cities' lower birth and mortality rates act as a centripetal force, intensifying the dynamics of concentration [34].

From the perspective of geographic visualization analysis, GIS is not only capable of tracking and forecasting aging trends to foresee the formation of NORCs but is also invaluable in analyzing the current layout of community resources and services. This functionality supports urban planners in designing environments that are more accommodating for the elderly. For instance, GIS enables the identification of medical facilities, parks, recreational centers, and shops within a community that are accessible to older adults, as well as assessing the accessibility of public transportation. Additionally, in the realm of health and emergency service planning, GIS aids in pinpointing the optimal locations and routes for services, ensuring swift responses in urgent situations.

Maricruz Rivera-Hernandez et al. found that despite a significant increase in the percentage of older homeowners and renters, the number of NORCs slightly declined over the ten-year period, confirming the existence of different patterns of NORC emergence, disappearance, and persistence [8]. Likewise, in Canada, Vincent G. DePaul developed and mapped out Dissemination Areas (DAs), choosing four cities to establish NORCs that include supportive service programs [13]. Conversely, this research employs census data to analyze the distribution of NORCs across Australia. Unlike the findings from research conducted in Ohio, USA, the total number of NORCs in Australia exhibits a persistent upward trend. Furthermore, the results of this study demonstrate the impact of sea change and urbanization on NORCs, whereas the findings from the study in Ontario, Canada, are more specific, addressing NORC types such as vertical (e.g., high-rise apartment buildings) and horizontal (e.g., mobile home communities).

The growth of NORCs will significantly enhance the ability of governments, social capital, professionals, and private investors to implement healthy aging programs. This occurs because NORCs not only facilitate healthy aging but also actively enhance the lives of older adults, their families, and their communities [35].

Furthermore, the concentration of a large number of older adults living in the same area (NORCs) generates economies of scale [36]. This scenario presents a beneficial opportunity for the government to provide home care and support services at a lower cost within these communities [37]. The concentration of older adults makes it easier and more cost-

effective to deliver services, as resources can be centralized and used more efficiently. This feature of aggregated living enhances the efficiency and cost-effectiveness of service delivery, as it allows for the concentration of resources, thereby reducing the logistics and operational expenses associated with widespread service distribution across larger regions [38]. Relative to offering extra medical or social services, healthy NORCs represent a cost-effective community-level strategy for promoting healthy aging [39]. During the fiscal year 2021–2022, the Australian governments (federal, state, territory, and local) allocated over AUD 25.1 billion to aged care services. Of this, 59% was directed toward residential aged care, while 33% funded home care and support [40]. As more older adults move into NORCs, the resulting concentration effect boosts economies of scale and promotes healthy aging. This has the potential to improve the efficiency of delivering age-specific services and delay the need for more intensive aged care settings, thereby reducing public spending.

Despite the substantial increase in NORCs and their growing importance in supporting healthy aging among older individuals, currently, the Australian government has not put in place any dedicated policies to support NORCs. Considering the various challenges that older adults may face when transitioning to new living environments due to factors such as age, lifestyle, and health status, older adults living in NORCs will greatly benefit from social interactions with peers who share similar lifestyles, interests, cultural backgrounds, and educational levels [41]. Formal recognition and adequate promotion of NORCs by governmental authorities would likely catalyze the formation of larger community conglomerations, given that NORCs inherently represent an aggregation of individuals united by shared interests and reciprocal attractions. This approach would not only fortify the sense of community belonging among the older individuals but also facilitate the provision of requisite socialization services with greater efficacy.

Conclusively, NORCs provide familiar environments and locations which enhance seniors' sense of belonging, facilitate the effective utilization of community services, and help maintain social connections through close relationships with friends. Studies have indicated that higher satisfaction with social networks and community integration correlate with lower feelings of loneliness [42]. Within NORCs, the high density of older adults increases the likelihood of both offering and receiving support among one another. According to the 2018 Survey of Disability, Aging, and Carers (SDAC) by the Australian Bureau of Statistics [43], almost all older Australians engaged in social activities both at home and outside in the previous three months. Additionally, a significant portion volunteered in their communities, indicating a strong desire for social connection and participation, aligning with the foundational reasons for NORCs and reflecting the overall growth trend of NORCs in Australia.

Since the concept of NORCs first emerged in the United States, most of the earlier research has been focused on the U.S. and Canada, primarily addressing aspects such as the environment, NORC programs, and the wellbeing of older residents in NORCs. This article focuses on the identification and preliminary analysis of the distribution patterns of NORCs in Australia, where NORCs have not yet received official recognition or policy support. The findings of this paper will provide local governments with data support for future policy making.

Given the results of this study, several key managerial implications can be drawn. Firstly, regarding urban planning and development, urban planners and developers can utilize the insights from this study to design and implement infrastructure that supports the needs of older adults. The evidence on how sea change and urbanization influence the formation of NORCs can guide future urban development projects to be more inclusive and supportive of senior citizens. Secondly, this study provides practical guidance for stakeholders by highlighting the cost-effectiveness of NORCs in meeting the actual needs of the aging population. It promotes and advocates for NORCs as a viable solution for aging in place. This can lead to more efficient use of public funds and better outcomes for older individuals. Lastly, the results of this study can assist government agencies in developing effective and localized policies aimed at promoting healthy aging in place. Understanding

the distribution trends of NORCs allows for better allocation of resources and targeted interventions to support older Australians' wellbeing.

Following the initial mapping of NORCs in Australia, future research can be conducted to delve deeply into the underlying reasons behind their formation, identifying which and how elements collectively contribute to these natural congregations of populations. Future research will focus on assessing the wellbeing of older adults living in NORCs through surveys, interviews, and focus groups. Reflecting social value post-retirement is a critical objective of active aging. Most older individuals, after retiring, lose their regular work routines and social interactions, making it challenging to maintain a sense of social value. The intensity of their social connections directly influences their overall happiness. Thus, continuing to engage in social activities and interact with the community post-retirement can significantly improve their mental health. The Naturally Occurring Retirement Community Support Service Program (NORC-SSP) advocates for the involvement of elderly residents in community building and the formulation of service plans. This approach provides opportunities for increased participation in community activities. One approach is to use older resident satisfaction surveys, health and wellbeing assessments, and resident committees to identify and incorporate residents' perceptions and needs into future residential planning. Additionally, fostering mutual assistance among residents, encouraging participation as community volunteers, and organizing diverse community activities can enable older adults to utilize their skills and capabilities post-retirement, enhancing their sense of pride and fulfillment.

5. Conclusions

The majority of older adults prefer to remain in their homes to enjoy their later years, yet the critical challenge lies in how to fulfill this desire. NORCs represent the optimal choice for achieving healthy aging [44,45], whether from the perspective of enhancing the welfare of the older adults or considering cost-effectiveness. This article leverages the latest ABS Census 2021 to map out the distribution of NORCs within Australia (based on SA1). It also compares the changes in NORCs over three census periods, highlighting a rapid growth within Australia, from 728 in 2011 to 1660 in 2021, thereby accommodating 15.9% of older household members. NORCs are primarily located in coastal and urban settings, and projections suggest a notable expansion in these areas in the coming years. It is imperative for governmental entities to develop and implement supportive policies and initiatives for NORCs. These efforts should aim to elevate the living standards of older adults and their families, thereby significantly contributing to the promotion of healthy aging.

This article significantly builds upon the foundational theories of NORCs by Xia and E, extending and deepening the research in this area. It reveals, for the first time, the distribution patterns of NORCs in Australia, filling a significant research gap and enhancing the understanding of NORC dynamics. Furthermore, this study enhances existing theories on urbanization and community development. In particular, it highlights how sea change and urbanization influence the distribution of NORCs, thereby enriching the discourse on the environmental and social determinants of aging in place.

From a practical standpoint, urban planners and developers can utilize the insights from this study to design and implement infrastructure that supports the needs of older adults. Furthermore, the evidence on how sea change and urbanization influence the formation of NORCs can guide future urban development projects to be more inclusive and supportive of senior citizens. Additionally, this study provides practical guidance for stakeholders by highlighting the cost-effectiveness of NORCs in meeting the actual needs of the aging population. It promotes and advocates for NORCs as a viable solution for aging in place. This can lead to more efficient use of public funds and better outcomes for older individuals. Moreover, the results of this study can assist government agencies in developing effective and localized policies aimed at promoting healthy aging in place. Understanding the distribution trends of NORCs allows for better allocation of resources and targeted interventions to support older Australians' wellbeing.

This study has some limitations. Firstly, the localized analysis in this paper is confined to a basic visual examination of the eight Greater Capital Cities, inherently limiting the scope to fully encompass all the details and characteristics in a single assessment. Therefore, future research might necessitate a targeted, in-depth exploration of specific areas to uncover the complex features and dynamics. Secondly, this paper highlights the influence of geographical indicators on the hotspot clustering of NORCs, taking into account factors such as sunlight exposure and lower mortality rates in urban areas. However, factors not included in the census data could significantly impact the development of NORCs. Among these, the distribution of aged care facilities and the built environment are noteworthy and warrant in-depth investigation in future research. Thirdly, it is crucial to further explore the role and impact of NORCs in regional economic development. Conversely, understanding how regional economies affect NORCs is essential. Employing Geographic Information Systems (GIS) and spatial econometric methods could facilitate a more detailed analysis of the relationship between the spatial distribution of NORCs and local economic indicators.

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