

The Impact of Social Infrastructure Planning on the Mobility of Inclusive Theoretical Model of Aging in the Context of Urban Renewal

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Abstract. The world's population is aging quickly, yet the social environment and most local infrastructure are not designed to assist the elderly. This is due to the possibility that older persons may exhibit distinct characteristics in their everyday travel behavior, related to age and physical capacity. In order to support older individuals, social infrastructure needs to be defined in a consistent and quantifiable manner. More research is needed to understand the connection between infrastructure and community health, well-being, and liveability. A global goal in population aging planning is to ensure an enabling and supportive environment. This essay examines the aging population in cities and how the structure of the urban environment interacts with the surrounding social milieu. By analyzing the mobility of the senior population in social infrastructure planning, through inclusive design and inclusive theory models, we aim to create infrastructure more in line with the needs and spontaneity of older inhabitants. Using a unique analytical framework, the technique of liquidity, and social infrastructure, this research examines the shifting dynamics of communities and the value of place for older persons living in places undergoing socio-economic redevelopment. The paper argues that social infrastructure must be seen as a key element of urban regeneration planning, ensuring that new spaces foster social connections across generations and support a sense of local identity, belonging, and inclusion among older residents despite significant physical transformation. This article offers fresh suggestions for government organizations and planners to address the issues of aging.

1. Introduction

As the world's population continues to age at an unprecedented rate, a deeper understanding of the agency of older individuals is crucial. By 2050, it is projected that 2.1 billion people will be 60 or older, up from 1 billion in 2019 (13% of the population) [1]. This increase in the senior population raises demand for city services, particularly for daily transportation. Despite this, older individuals are often misunderstood and viewed as helpless [2]. Research has shown that inadequacies in infrastructure and legislation often lead to conflicts between senior citizens and other road users or passengers [3]. These issues can have negative consequences for overall societal development.

Studying the daily travel patterns of older individuals can help us better understand their unique travel needs and characteristics, and serve as a foundation for developing innovative service models, infrastructure improvements, and policy formulations that will improve their quality of life. Ensuring an enabling and supportive environment for older individuals is a global goal for population aging planning [1]. A recent study discovered that the advantages of the local environment were the most

important of the elements that elderly people reported impacting their quality of life [4].

A review of publications on the topic of older persons, mobility, and sustainable transportation between 2006 and 2020 (Figure 1) shows an increasing trend in the number of articles published on the subject. However, it is noted that the majority of research has focused on the economic impact of structural changes imposed by IMF during downturns, which have harmed welfare in certain countries and often force older individuals to rely on family support [5]. rather than considering the impact on urban infrastructure planning.

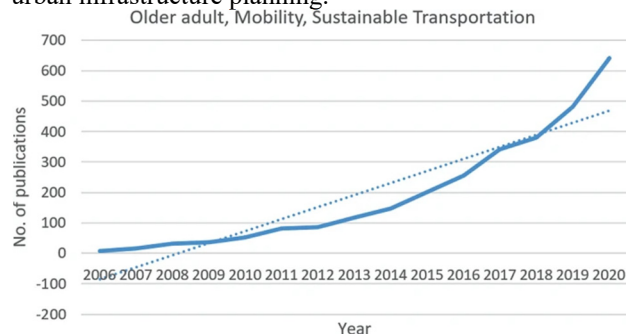


Figure 1. Trends in publications on the elderly, Mobility and sustainable transportation

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The growing demand for older individuals to care for dependents and other older people is a result of the prevalence of neoliberal government policies and their tendency to cut back on welfare services, particularly social care [5]. This essay argues that conversations concerning the development and design of urban infrastructure for older people are frequently dominated by age-related and physical features of older individuals. Instead, there is a need for a more nuanced and realistic view of aging that takes into account the broader social, economic, and political realities.

This method enables us to examine how social, economic, and physical mobility shapes the strategies and strategies of aging urban residents to address more general structural issues, such as the deterioration of the national and urban transportation infrastructure [6], unequal national policies for older populations that typically place a greater emphasis on children, young people, and adults in their working years, and unstable living conditions [7].

The work of alternative new transportation paradigms and Simone's analytical insights on the idea of "people as infrastructure" in everyday urban life served as the foundation for this essay [8]. These methods are being employed to understand and emphasize the many complicated responsibilities, livelihoods, and uncertainties that older people face in general. To achieve this, the essay examines the interactions between everyday mobility, life-cycle migration, and immobility. It then uses complicated kinds of "collaboration," "integration," "coordination," and "speculation" to shape the social actors involved [9].

2. Literature review

Previous studies have shown that designers and managers often lack a comprehensive understanding of the needs and abilities of older adults and individuals with disabilities [10]. Inclusive design, in contrast to earlier design strategies that targeted specific groups, aims to create an environment that is accessible and accommodating for everyone. For instance, the accessible design tries to remove physical obstacles in the built environment for individuals with impairments, while intergenerational design aims to include aging in the design. Inclusive design acknowledges that designing for everyone is challenging, and acknowledges the concept of "design exclusion." It is crucial to thoroughly comprehend their demands, as the primary goal of inclusive design is to put people at the center of the design process. Roger Coleman coined the phrase "inclusive" in the UK in 1993 [11]. As attitudes towards aging and disability change, the importance of ergonomics in the design and evaluation of everyday products and environments is emerging to ensure that they allow for the widest possible range of capabilities in user profiles [11]. Inclusive design acknowledges that no design will be perfect for everyone [12] and can also provide "examples of how this notion might be utilized in practice" and "assist [manufacturers and retailers] in realizing the potential commercial benefits of their business" [11].

Inclusive design, as championed by Clarkson and Coleman [13], aims to incorporate older adults and individuals with disabilities into society as a whole, rather than treating them as separate groups with "special needs" as past design methods did. This is because inclusive design recognizes that everyone's physical abilities are transient, and everyone will eventually become disabled, whether temporarily or permanently. Therefore, design should not take into account the needs of individuals with impairments as a distinct category, but rather treat everyone equally [12]. In other words, it "moves the emphasis from them (the old and the crippled, to use academic jargon) to us" [13].

The stress-capacity model (competence) proposed by Lawton and Nachmo states that a person's ability to cope with a demanding environment and physical and social constraints (stress) contribute to aging. When environmental stress and personal demands are consistent, it promotes mental and physical health; when they are not, it has the opposite effect [14]. The environment is more likely to harm older persons as they age because they are more prone to have impairments [15]. Older adults are also more likely to spend time in their immediate neighborhood and their living quarters become smaller [16], which means that their health becomes more dependent on their neighborhood surroundings [17].

Walkability is a crucial aspect of an environment designed to accommodate older adults [18]. Recent research has discovered that older persons endure a range of pressures, including physical and cognitive weaknesses, changes in space-use patterns, and social support networks relying on community and family [19]. However, the European and North American contexts place conceptual and empirical restrictions on this type of study on the mobility of the elderly [20]. The analysis can be expanded by including aging identities, expectancies, and experiences across the life cycle. to include aging identities, expectancies, and experiences across the life cycle. Mobility, according to Rigg, "becomes a crucial component of how people understand themselves in the context of the larger community, and how society collectively views itself." [8].

Investigating how older adults' lives are affected by changes in the urban environment can help us better understand their mobility and daily living experiences. Studies have shown that urban circumstances and urban life are often conceptualized and studied from the perspective of "infrastructure" [20]. By repurposing infrastructure, we can learn more about how older adults can utilize mobility to provide often-unnoticed societal and economic benefits. McFarlane and Silver argue that by studying "the multiple forms of urban life," which include various networks and combinations of communication, objects, physical landscapes, modes of transportation, and caregiving relationships, we can gain a better understanding of aging mobility [21].

Including social infrastructure in discussions of mobility offers a fresh perspective through which we can examine the socioeconomic values of older adults, who may appear "marginalized and isolated from urban life"[21] but in fact, express various "chaotic" city

expressions in their movement and, as a result, create new urban forms [22]. This study argues that "migration and mobility have historical foundations" while acknowledging that "a theory of change needs an admission that gender, class, race, and other social interactions are influencing mobility.

Urban revitalization might result in the creation of additional social infrastructure, including better public transportation systems, investments in parks, and the launching of new businesses, which could support the practical aspect of aging in place. According to Shaw, the loss of infrastructure can have detrimental effects on well-being, leading to feelings of alienation and insecurity [23]. Government budget cuts, which are often a result of austerity measures, can exacerbate these negative effects, resulting in the loss of both social and physical spaces. The destruction of a community's social infrastructure can have a "shrinking" effect on the social world of older adults, eroding their sense of belonging and identity in neighborhoods that have already experienced reduced investment due to chronic poverty. This is especially concerning, as older adults are often more dependent on their immediate surroundings for their physical and mental well-being.

3. Research Method (Methodology)

This research aims to analyze the mobility of the senior population in the context of urban regeneration through social infrastructure planning. The inclusive design inclusive theory paradigm will be applied as a conceptual framework. The framework's social infrastructure component is based on literature review and the concept of neighborhood as it is used in current spatial planning to depict the links between the homes of elderly people. The framework illustrates how environmental or neighborhood characteristics, such as access to social infrastructure, may impact and link other downstream determinants, as well as the health-related social determinants of upstream social infrastructure determinants (such as long-term physical and mental health outcomes).

Research by Barton et al. and Barton suggests that the physical development of blocks and effective spatial planning can be used to achieve optimal health benefits for the entire community [24]. These concepts align with the healthy neighborhood design ideas proposed by these authors. The framework of spatial planning decisions, surroundings, lives, and experiences is supported by a significant amount of evidence [24].

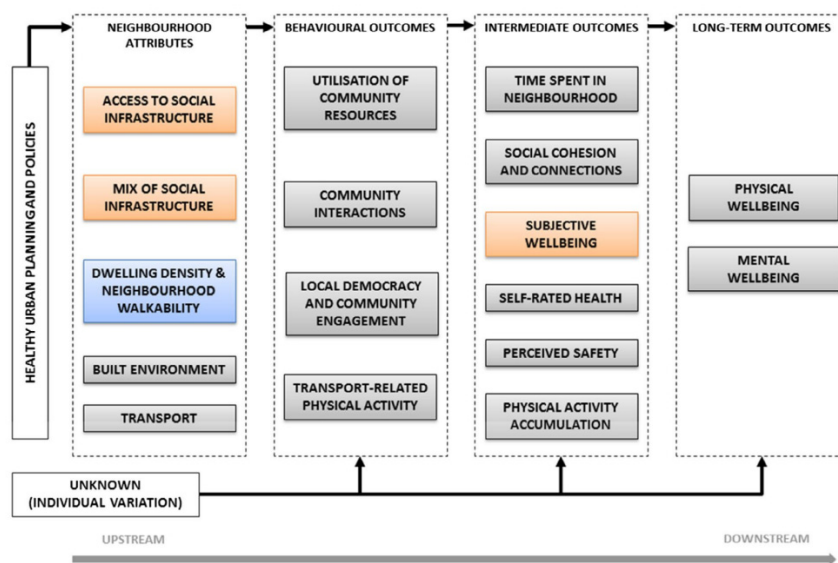


Figure 2. A conceptual model of social infrastructure, health and well-being that defines community attributes, behavioural outcomes, medium-term outcomes and long-term outcomes to promote healthy urban planning and policies.

This research aims to study the link between the architectural and social environment in terms of older people's vulnerability by examining the spatial relationships between supportive built environments and social infrastructure. A combination of spatial and statistical analysis is used, with the Greater Melbourne region as a case study. The study focuses on the functional region of statistical Region 2 (SA2), which covers an area of between 3,000 to 25,000 people, mostly representing various suburbs, and serves as an acceptable spatial profile for the investigation [25]. In the study, we used 257 SA2s from the Greater Melbourne region. Data on seniors is collected from the 2016 Australian Census of Population and Housing, focusing on adults aged 65 and older, and adults aged 85 and older, who are considered more

vulnerable due to increased susceptibility, decreased activity, and limited independence [26]. Although not all persons over the age of 85 face more severe cognitive and physical issues, adults over the age of 85 frequently do [27]. The proportion of each group in the population and the proportion of residents who live alone in each group is also considered as a measure of vulnerability [28].

A social infrastructure database is created for the Greater Melbourne metropolitan area, focusing on the three categories of public, non-profit, and educational social infrastructure, which are considered crucial elements of social infrastructure [29]. The analysis is based on Gordon's Typology Suburban Peoples Project, which documents the evolving built environment of Greater Melbourne. The research created and evaluated several models to represent a wide range of constructed

settings in major cities in Australia and Canada, both of which are predominately suburban. The study suggests that traffic behavior models are more useful for simulating urban and suburban settings in both scenarios [30]. The metropolitan form of the built environment is categorized into different types of areas such as an activity center, a transit suburb, an automotive suburb, an exurb, and others. The study focuses on the relationship between the built environment, social infrastructure, and possibly vulnerable elderly individuals in this area spatially.

SA2s that have activity transport to work rates at least 150% higher than the Greater Melbourne norm are considered to be part of an activity core. SA2s with lower

traffic rates and higher public transportation usage than the metropolitan average are classified as transit suburbs. SA2s with both lower traffic and public transportation usage than the metropolitan average are classified as automotive suburbs. Suburbs with a population density of fewer than 150 persons per square kilometer are considered primarily rural regions. SA2s with little to no permanent inhabitants, such as industrial zones and cemeteries, are classified as "other." The Greater Melbourne region is composed of 169 automotive suburbs, 19 transit suburbs, 29 exurbs, and 40 vibrant core communities.

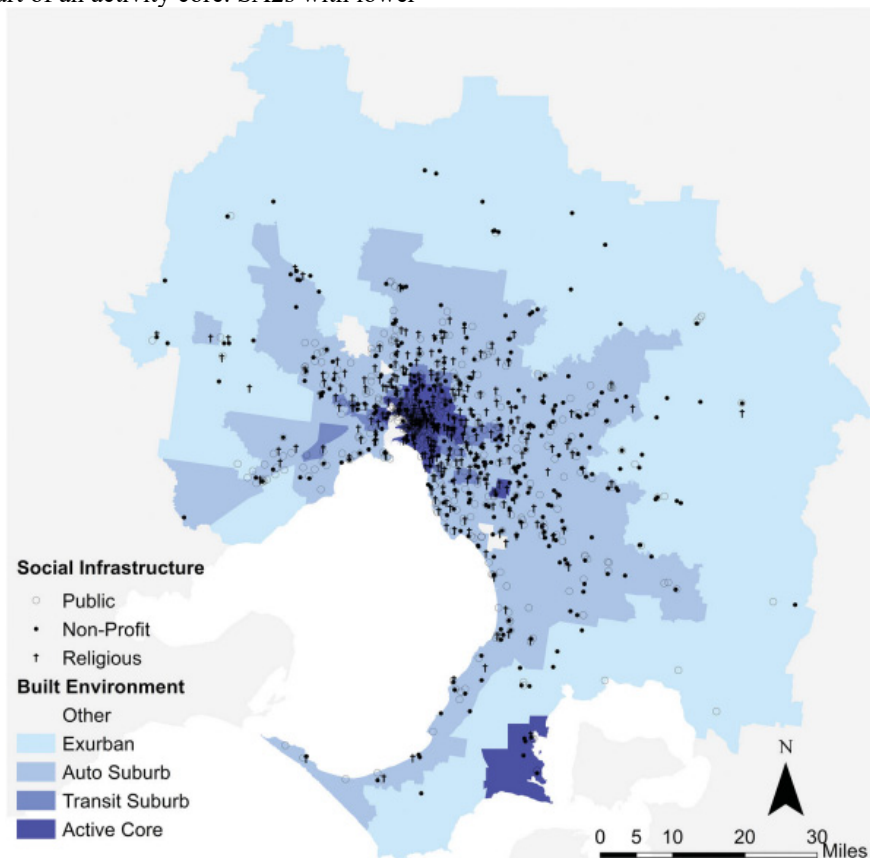


Figure 3. Social infrastructure and built environment in Greater Melbourne.

Figure 3 illustrates the distribution of social infrastructure (public, nonprofit, and religious) within different built environment categories (activity core, bus suburb, auto suburb, exurb, and others) on a community map. This map clearly shows how social infrastructure is concentrated in more densely built environments. The geographical distribution demonstrates that the predominance of social infrastructure steadily declines along the urban-suburban-exurban hierarchy.

To further examine the relationship between built environment and social infrastructure, a series of analyses of variance tests were conducted (as shown in Table 1). These tests supported the pattern observed in Figure 3, with active core towns having the highest amount of social infrastructure, followed by bus suburbs, auto suburbs, and then exurbs. Additional analysis of variance tests were also conducted, taking population density into consideration to determine if social infrastructure was disproportionately distributed in more urban areas.

Furthermore, the distribution of social infrastructure for older individuals was also analyzed by examining the infrastructure density per 1,000 inhabitants, per 1,000 adults aged 65, per 1,000 people aged 65 living alone, per 1,000 adults aged 85 living alone, and per 1,000 adults aged 85 living alone. The results, even after accounting for population density, show that the social infrastructure provides an important perspective for investigating in active core towns is statistically significant and disproportionately distributed, with decreasing amounts as one moves up the urban-suburban hierarchy to exurban areas. When looking specifically at older individuals, this pattern is even more pronounced. For example, active core towns have more than three times as much social infrastructure per 65-year-old adult compared to automotive suburban areas. This spatial mismatch is particularly notable for those above 85 years of age, with active core towns having more than six times as much

social infrastructure per 1,000 adults in comparison to automotive suburban areas.

Table 1. ANOVA tests comparing mean levels of social infrastructure per neighborhood (SA2) across built environment types.

	Active Core	Transit Suburb	Auto Suburb	Exurban	p Value
SI total	8.93	3.79	3.33	2.78	<.001
Public	1.33	0.84	1.06	0.62	.071
Nonprofit	5.50	1.21	0.92	0.21	<.001
Religious	2.1	1.21	0.92	0.21	<.001
SI per 1,000 pop	0.65	0.28	0.22	0.26	<.001
SI per 1,000 pop 65+	7.18	2.26	1.48	1.83	<.001
SI per 1,000 pop 65+ alone	29.87	8.82	7.72	10.80	<.001
SI per 1,000 pop 85+	78.90	14.38	13.00	23.83	<.001
SI per 1,000 pop 85+ alone	246.23	53.40	42.47	81.34	<.001

Note: SI=Social Infrastructure

The degree and scope of older people's sensitivity to their physical and social surroundings. We looked at how many people in four distinct age groups lived in various social and architectural settings. The groups of the elderly (65, only 65, 85, only 85) and the forms of built environments (activity core, bus suburbs, vehicle suburbs, exurbs) are also distinct. To categorize each community's level of social infrastructure (SA2), we utilized the location quotient. Low-infrastructure areas are those having social infrastructure per capita below the metropolitan average, whereas high-infrastructure areas have more social infrastructure per capita than the national average. Table 2 provides a summary of the population distribution by neighborhood type. Over half of older persons live in neighborhoods with weak social infrastructure, and over 70% of them reside in automobile suburbs across all four categories, according to our research. Additionally, nearly half of the four categories reside in underdeveloped suburban communities. Less than 10% of elderly individuals in all four groups reside in suburbs. Although more than half of people who live in transportation suburbs have high levels of social infrastructure, older people who live in these areas do not receive the same level of support as older people who live in active core communities, where older people benefit from a better-built environment and high levels of social infrastructure.

Table 2. Absolute and proportional distribution of older adult populations in active core, transit suburb, auto suburb, and exurban neighborhoods by level of social infrastructure.

	Population 65+		Population 65+ alone		Population 85+		Population 85+ alone	
	n	%	n	%	n	%	n	%
Active core	69,2223	12	18,879	15	10,028	12	3,030	12
Transit Suburb	35,948	6	9,424	8	6,575	8	2,153	9
Auto Suburb	42,884	73	85,863	70	59,536	74	18,295	74
Exurban	44,802	8	8,013	7	4,350	5	1,131	5
Total	562,857	100	122,179	100	80,489	100	24,609	100
Active core low SI	15,252	5	4,681	7	2,096	5	747	6
Transit Suburb low SI	16,903	5	4,735	7	2,884	7	1,026	8
Auto Suburb low SI	261,878	81	51,487	79	35,581	83	10,621	81
Exurban low SI	27,957	9	4,664	7	2,521	6	644	5
Total low SI	321,990	100	65,567	100	43,082	100	13,038	100

Note: Low SI = neighborhoods with less social infrastructure per capital than the metropolitan average. SI = social infrastructure

4. Results and discussion

This essay argues that regeneration plans must take into account the emotional and social aspects of community life in order to sustainably support the aging population. Instead of solely concentrating on the physical aspects of new communities, this may call for investment in social enterprises, skill-training programs, and community development and assistance. The demands of various groups, including those of new families with small children, and middle-aged and long-term inhabitants, including the elderly, must be considered in discussions on urban redevelopment strategies [31].

As a result, plans for urban regeneration should give careful thought to social infrastructure. The research emphasizes the importance to preserve older people's key spaces throughout reconstruction to give them a platform from which to be seen and heard [32]. Research has shown that urban revitalization often only benefits specific populations, such as younger and more affluent residents [31], while neglecting the impacts on the aging population. The repaid physical rebuilding of neighborhoods can result in exclusion, isolation, or emotions of "being out of place" [31]. However, it's also crucial to keep in mind that adaptation happens when older individuals undergo physiological changes in their environment [33].

Social infrastructure is crucial to supporting community life and tackling some of the most urgent concerns in modern urban living, such as social isolation and sparse social networks, in urban redevelopment projects in the future [34]. Such communal Spaces "offer crucial forums for tackling society's urgent concerns, including isolation, crime, education, addiction, physical inactivity, starvation, and sociopolitical division". To retain social links and community cohesiveness, social infrastructure is essential for communities going through fast change. Social infrastructure, such as community spaces, is crucial for supporting community life and addressing urgent concerns such as social isolation and sparse social networks in urban redevelopment projects.

To provide specific advice on how older people might affect and contribute to urban redevelopment processes, more study is required. To come up with innovative ideas for equitable development, stakeholders from various sectors including policy, industry, community, and academics will need to form new working connections. Ongoing engagement and consultation with existing residents is crucial to understand their expectations and ensure they feel included in the process. Traditional methods of consultation may be limited, thus a more open collaborative approach should be encouraged. Urban public spaces, such as those waiting for renovation, may not make it immediately clear what is going on there or what purpose they serve [35]. It is important to understand the significance of social infrastructure from the perspective of residents, particularly in regards to urban public spaces undergoing renovation.

5. Conclusion

This article examines the significance of social spaces in communities that promote inclusivity and facilitate social connections among individuals. The concept of social infrastructure provides a valuable perspective for analyzing the effects of urban renewal, particularly in regards to the mobility and well-being of the senior population. To ensure that new urban Spaces foster social connections across generations and support a sense of local identity, belonging, and inclusion among older residents amid significant physical transformations, the paper makes the case that social infrastructure should be given a prominent place in discussions of urban change.

As individuals age, a combination of elements at the individual and community levels are necessary to support their everyday activities [36]. Communities that are highly walkable and have accessible social infrastructure help preserve and enhance physical and mental health as people age. However, not every community offers the same amount of assistance. We discovered that communities with lower levels of built environment support (i.e., automatically dependent suburban communities) also had lower levels of social infrastructure in our study of rapid aging and overwhelming suburbs [37] in the Greater Melbourne metropolitan area. This highlights the importance of converting underdeveloped towns into age-friendly neighborhoods in order to support older individuals who wish to age in place.

This case study illustrates the connection between Greater Melbourne's uneven built environment topography and the uneven distribution of social infrastructure. Communities with supportive built environments and transportation connections receive the majority of public attention, while vehicle suburbs and exurbs with less connectedness and lower average incomes are often ignored. By addressing urgent issues with housing and transportation, targeted actions to enhance the physical environment in such communities can provide a favorable climate for the development of social infrastructure. To ensure that unsupported communities are not neglected and to enhance them for the benefit of aging and possibly isolated vulnerable populations, planning and policy interventions must take into account the connections between the built and social environments. This regional study suggests that future research should focus on the opinions of planners, policymakers, and local citizens at the local level, and include more indicators of community features and social infrastructure.

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