

The age-friendly public city: initial reflections of a medium-size city as Bergamo

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Abstract

The demographic trend of aging is a global phenomenon, but it manifests differently across countries. Italy is one of the “oldest” countries in the world, and this phenomenon is even more pronounced in urbanized contexts. At the same time, in Italy, most people over 65 live in medium-sized cities, they continue to age at home and in their neighborhood (Aging in Place). This paper aims to present the first phase of the research funded by the Next-Generation EU initiative, titled “CASA Aging in Cities-Medium: How Housing Conditions and Urban Spaces Can Reduce or Increase Opportunities for Longevity in Health”. The research develops a multiscale and interdisciplinary analytical model to investigate how urban space influences healthy aging and neighborhood attachment, using Bergamo as a representative case of medium-sized Italian cities.

Keywords: Aging in Place, Elderly, Medium-sized City, Neighborhoods, Public Spaces

Introduction: the Role of Territory and the Spatial Dimension in Healthy Ageing

Between 2015 and 2050, the proportion of the global population aged 60 and over is expected to nearly double, increasing from 12% to 22%. By 2030, one in six people worldwide will be over the age of 60. According to recent estimates, the number of individuals in this age group will rise from 1 billion in 2020 to 1.4 billion, and is projected to reach 2.1 billion by 2050. The population aged 80 and over is also expected to triple in the same period, reaching 426 million (WHO, 2024). While global aging is a widespread phenomenon, it presents distinct patterns and challenges across different national and urban contexts.

The concepts of well-being and health are inextricably linked to the territorial dimension, and it was already in the first half of the 19th century that the role of spatial planning in contributing to the establishment of a democratic community became evident (Benevolo, 1963), particularly in addressing the public health issues posed by the emerging industrial cities. Urban planning also plays a pivotal role in this context, given the robust and intricate relationship between the built environment and the health of the elderly. The built environment encompasses factors such as community safety, accessibility to services and environmental quality, which have the capacity

to exert a substantial influence on the health outcomes of the elderly in terms of both physical and mental well-being.

A major recent study based on the UK Biobank (Argentieri et al., 2025) quantified the impact of environmental and genetic factors on the ageing, mortality and incidence of 22 age-related diseases. The study demonstrated that environmental factors have a greater influence on mortality risks than genetic factors (17% versus 2% of variation in risk of premature death can be attributed to environmental factors). Certain diseases, including cardiovascular, respiratory and hepatic pathologies, are significantly influenced by environmental factors, accounting for up to 49.4% of the observed variability. The most significant environmental factors associated with mortality include smoking, socio-economic status, physical activity, sleep quality, social isolation and air pollution. Spatial planning, therefore, plays a key role in promoting health and ageing, often overriding the contribution of genetics. This suggests that spatial planning interventions may have the potential to contribute to the prevention of disease risk, thereby facilitating healthy ageing. Additionally, the promotion of public policies that address socio-economic inequalities, promote healthy lifestyles and improve environmental conditions can have a significant impact on population health.

Italy, which is among the countries with the highest aging rates globally, is experiencing a faster demographic shift than much of Europe. This transformation is particularly evident in urban areas, where the effects of ageing are more pronounced. A considerable proportion of Italy's older population – that is to say, individuals aged 65 and over – reside in medium-sized cities and continue to age in place, remaining in their homes and communities. In such contexts, the spatial and functional organisation of urban environments exerts a substantial influence on the daily lives and health trajectories of older adults. It is crucial to recognise the pivotal role that public spaces play in either facilitating or hindering the routines, mobility, and social engagement of ageing populations.

This article presents the initial phase of an ongoing research project funded by the Next Generation EU initiative, titled CASA Aging in Cities-Medium: How Housing Conditions and Urban Spaces Can Reduce or Increase Opportunities for Longevity in Health. Specifically, the contribution delineates the theoretical and methodological approach that was used to develop a multiscalar and interdisciplinary analytical model to explore how urban spaces influence healthy ageing and the sense of neighbourhood attachment among older adults. The present research focuses on the city of Bergamo, in northern Italy, which is considered a representative case of medium-sized Italian cities. The objective of the present study is to shed light on the impact of urban structure on healthy ageing, and to examine the primary effects that high-quality urban environments have on older demographics.

The objective of the research is to understand the characteristics and effectiveness of public spaces in promoting health and social inclusion. This is achieved by integrating physical, functional, performance (in relation to climatic and environmental factors), and decision-making dimensions. The research also explores the barriers that limit the use of public spaces, such as extreme temperatures or physical obstacles. Moreover, the objective is to unveil the inherent heterogeneity amongst different neighbourhoods within a single city.

The Age-Friendly City

Healthy ageing is recognised as a global priority, as evidenced by the numerous initiatives of international bodies, e.g. The United Nations Decade of Healthy Ageing (2021-2030) (UN, 2020) emphasised the importance of the spatial dimension for the resilience of older communities, particularly in post-pandemic contexts. The Cities for All Ages project (OECD, 2025) reinforced the idea that urban infrastructure can (and should) be an ally of public health. The World Health Organisation's National Programmes for Age-Friendly Cities and Communities (WHO, 2023) also provide guidance on this topic.

The notion of age-friendly cities and communities (AFCC) was first introduced in the inaugural report published in 2007 by the World Health Organisation. The objective of the AFCC concept is to promote urban environments that encourage healthy ageing and to provide support for national programmes that are designed to create more

inclusive and all-age-friendly settings (Torku et al., 2020; Hoof, 2021). The objective of the project is to promote the well-being, health and social participation of older people, with a particular emphasis on enhancing active and independent living within their communities. The model's eight core areas of focus encompass outdoor spaces and buildings, transport, housing, social participation, respect and social inclusion, civic participation and employment, communication and information, and community support services and health. A number of studies have employed this model to assess the efficacy of initiatives implemented within specific territorial contexts. These studies have analysed urban policies and the experience of senior citizens (Perek-Białas et al., 2024; Ivan et al., 2024).

The planning of an age-friendly city is not only concerned with the elderly population; it also brings with it additional benefits, including those of pursuing sustainable urban development goals and fostering the implementation of social inclusion programmes (Han et al., 2021; Buffel et al., 2020). Furthermore, the development of smart cities as AFCC policies exploit technology and innovation (Hoof et al., 2021) is also a benefit. Concurrently, numerous challenges persist in the realisation of an age-friendly city, particularly those related to aspects of social exclusion and economic sustainability (Murtagh et al., 2021). A pertinent example of this phenomenon is the disparities observed between residing in urban and rural environments. It is an established fact that older populations tend to be more concentrated in rural areas. In addition, it is equally well-documented that rural areas tend to have lower income levels, less access to health and social services and higher levels of social isolation. These factors, it can be hypothesised, potentially contribute to the observed variations in health outcomes. A number of studies have indicated that the over 65s residing in urban areas demonstrate superior health in comparison to their counterparts residing in rural areas. The most recent Eurostat report has indicated that the over 65s residing in urban areas are believed to exhibit superior health in comparison to their counterparts residing in rural areas (Eurostat, 2023).

In the context of healthy ageing, it is also beneficial to take into consideration the changes to which the territory is subjected. Since the 1970s, and particularly in recent decades, the phenomenon of gentrification has been a subject that has attracted considerable attention. Indeed, the process of physical and socio-cultural transformation of urban neighbourhoods has been demonstrated to exert a strong influence on the elderly population (Santos et al., 2024).

Elderly People and Climate Change

The concept of 'ageing in place' must be contextualised within the most pressing global public health challenge of our time, namely climate change. It is evident that this crisis will have profound consequences for the health of the population, as it is already exerting a considerable impact on food systems, the increased spread of infectious diseases and growing risks for non-communicable diseases and mental health, rising temperatures, accessibility to certain areas, and extreme weather events (IPCC, 2022). While urbanisation has facilitated enhanced access to healthcare, it has concomitantly precipitated deteriorating air quality and the loss of green spaces. In this regard, the presence of urban greenery and Nature-Based Solutions (NBS) assumes particular significance, given their capacity to offer opportunities for physical activity, stimulate social interaction and community cohesion, and enhance the landscape. These factors have been demonstrated to exert a positive influence on mental well-being (Xu et al., 2023; Zhang et al., 2022). The aforementioned benefits are more pronounced in low-income populations, where green spaces mitigate urban heat islands and provide relief in areas with limited access to air conditioning. Urban planning that incorporates these factors has the potential to reduce inequalities and promote environmental justice, ensuring that all individuals have an equal right to robust environmental protection and to be informed and involved in decision-making processes.

Climate change has the potential to expose the elderly to a multitude of risks, including heat waves, floods, forest fires and air pollution. The impact of these risks on vulnerable populations is compounded by factors such as physical frailty, chronic diseases, social isolation and poverty (Prina et al., 2024; Hua et al., 2024; Gaugler, 2024; Dabelko-Schoeny et al., 2024; Katey & Zanu, 2024). For instance, the presence of urban green spaces has been demonstrated to play a pivotal role in the promotion of healthy ageing, offering a range of physical, mental and

social benefits that are especially pertinent for the elderly population. Individual and societal vulnerabilities have been shown to increase exposure to climate impacts, accelerating the ageing process and necessitating the integration of climate, environmental and social strategies into public policies. It is therefore crucial to promote adaptation approaches that recognise the active role of older people, not only as vulnerable individuals but also as resources for mitigation through their experience, knowledge of sustainable practices and ability to contribute to community initiatives. In this context, active ageing and climate resilience must be addressed in unison, with the involvement of older people in the construction of more inclusive, sustainable communities that are capable of coping with environmental challenges.

Walkability and its Barriers

Walkability, defined as the quality and accessibility of pedestrian environments, constitutes a vital element in the promotion of healthy ageing. For older people, walking is not only a means of transport; it is a fundamental activity that contributes to the maintenance of autonomy, physical well-being, cognitive function and social inclusion. However, the promotion of walking in old age necessitates the establishment of safe, accessible, continuous routes equipped with amenities such as benches, public toilets and green areas (He & He, 2025; Hu et al., 2025; Kim et al., 2024). A plethora of factors must be considered when assessing the walkability and appeal of a given space for older individuals. These include, but are not limited to, safety measures aimed at mitigating the risk of accidents and crime, the presence of wide pavements, the presence of street furniture, the variety of destinations along designated pathways, and the presence of aesthetically pleasing elements such as greenery. The importance of these factors in enhancing the walkability and appeal of spaces for older people has been extensively researched and documented (Appolloni & D'Alessandro, 2023; Bailey-Catalán et al., 2025; Knapskog et al., 2019).

Rising temperatures, exacerbated by climate change and the urban heat island effect (UHI), represent a significant barrier to the utilisation of public spaces by older people. As the global climate continues to warm, high temperatures have been shown to have a detrimental effect on the liveability of urban environments (Cheng et al., 2012; Alnimer et al., 2023). This is due to the fact that high temperatures can inhibit physical activity and outdoor sociability, both of which are fundamental to mental and physical well-being in old age. Excessive heat has been shown to act as an invisible barrier, with both physiological and psychological effects, which are accentuated in urban areas where temperatures can exceed those experienced in rural areas by more than 10 °C (Heisler & Brazel, 2010; Stone et al., 2010). This is due to a reduction in green areas, an increase in impermeable surfaces and anthropogenic emissions. The elderly are among the most vulnerable to the effects of heat, due to lower thermoregulatory capacity, reduced thirst perception and pre-existing chronic conditions (ASUGI, 2020; Ministry of Health & CCM, 2019).

Prolonged exposure to elevated temperatures has been demonstrated to induce a range of physiological responses, including dehydration, syncope, and heat stroke, which can result in an elevated risk of mortality (Ministry of Health & CCM, 2019; IIPH, 2022). In Italy, for instance, research has shown that the mortality rate on the hottest days can increase by up to 20.3% (IIPH, 2022). Furthermore, the impact of heat on mental health has been demonstrated to be a significant contributing factor to the prevalence of anxiety, depression and stress (IIPH, 2022).

In this context, urban design assumes a crucial role: shaded spaces, the presence of vegetation and reflective materials are effective interventions to improve pedestrian thermal comfort and make public spaces accessible even in warmer seasons (Nasrollahi et al., 2020; Jia & Wang, 2021; Huang et al., 2022). The promotion of outdoor living in temperate climates has been demonstrated to be a contributing factor to the maintenance of physical activity, social interaction and, consequently, the health of the elderly population.

Healthy Ageing e Vulnerability

A key concept guiding this research is environmental vulnerability. Environmental vulnerability refers to the capacity of territories to suffer damage due to exposure to different types of stress, including environmental and social changes, and vice versa to the consequent lack of capacity to adapt to such changes. This vulnerability

is often the result of political choices and urban planning that has failed to listen to the needs of territories and populations, particularly the most fragile ones. Geographical studies have shown how such decisions contribute to significant disparities in health between different geographical areas (Anderson et al., 2025).

The concept of environmental vulnerability is multifaceted, with numerous factors contributing to its manifestation. The primary factors encompass the degree of urbanisation, as increasing populations migrate to urban areas, resulting in the loss of green spaces and elevated levels of pollution (Sheykhi, 2022). The organisation of urban space, the distribution of services, the quality of infrastructures, and the presence of green areas are not neutral elements, but rather determinants of the physical and mental health of the population, particularly the elderly (Xu et al., 2023).

Cities not only host but also shape the life experiences of older people, amplifying or reducing their risks, and to promote an improvement in quality of life during the ageing process, it is necessary to integrate health and psychological dimensions with spatial and environmental ones. From the perspective of the elderly, the issue of vulnerability has to be addressed in different ways, as a number of characteristics can be used to represent it (Channer, 2020). Low income, for example, which can be configured in terms of economic vulnerability, is a recurring factor in a number of cross-sectional studies aimed at representing the vulnerability of the elderly (Smeeding, et al., 2008; Stewart et al., 2011; Allan et al., 2011; Clarke e Gallagher, 2013). The comprehension of environmental vulnerability necessitates an investigation at multiple levels, including the examination of individual vulnerabilities (i.e. the physical and functional, the economic, and the social) as well as the environmental, institutional, and regulatory aspects.

Individual vulnerabilities encompass not only a potential decline in health, but also in mobility or cognitive abilities, as well as possible mood problems, possibly secondary to a problem of social isolation. Individual vulnerabilities are often compounded by environmental factors, leading to the perception of physical or psychological barriers in one's immediate surroundings. This can result in a sense of restriction in day-to-day activities. These factors have the potential to compromise security and independence, thereby increasing exposure to the risk of an ageing trajectory of frailty (e.g. falls, illness or isolation). As previously mentioned, economic vulnerability refers to the interaction between older people and their environment. This is characterised by a lack of financial resources, which limits the ability of older people to maintain or adapt their homes, access home care services, or meet the costs of daily living. The existence of insecure housing has a detrimental effect on the mental and physical well-being of individuals, giving rise to feelings of uncertainty and chronic anxiety. This, in turn, has a deleterious effect on the quality of life and can result in a trajectory of vulnerability to age-related frailty. Social and relational vulnerability, due to the loss of meaningful ties, withdrawal from community life or the absence of informal support networks, may need to be compensated by an AIP that has social infrastructures (community centres, transport, intergenerational initiatives) capable of supporting active ageing and, above all, of sustaining a culture aimed at promoting an assumption of responsibility by ageing individuals. As previously evidenced, the risk of social isolation and consequent feelings of loneliness can exert a detrimental effect on mental health (Nicholson, 2009).

Measuring Social Vulnerability and the Elderly Population

Vulnerability is an inherently probabilistic concept, expressing the degree to which an individual or group is exposed to harm, i.e. proximity to risk. This phenomenon does not necessarily result from a specific exposure or negative outcome; rather, it is the cumulative outcome of a combination of interdependent factors. These factors include the risk of exposure to a threat, the risk of that threat materialising, and the risk of not having adequate resources to deal with it (Schröder-Butterfill and Marianti, 2006). Consequently, elements such as variability in the probability of exposure, the scope and frequency of threats, and differing capacities to respond and adapt, contribute to varying degrees to determine both the likelihood of negative outcomes and their possible severity. The dimensions of vulnerability have the capacity to interact with each other in a compensatory manner or to reinforce each other, thereby generating different levels of vulnerability with regard to proximity to harm and its intensity. Furthermore, in specific contexts, certain of these dimensions are closely intertwined. For instance,

consider the link between exposure and threat, where it is the context itself that generates the risks and defines who is exposed to them. It is therefore the case that vulnerability is not a static attribute; rather, it is the product of individual and collective life paths. In this sense, past experiences influence the present conditions of exposure and the available “defence” strategies.

The increasing tendency of the population to reside in urban areas is often linked to manifestations of socio-economic disparity, including inequitable access to services, resources, employment prospects and educational opportunities. In this context, the configuration of urban space assumes a key role in determining the living conditions of citizens and their ability to overcome situations of deprivation, both material and social. Consequently, the mapping of social vulnerability, with particular emphasis on its spatial distribution, emerges as a core instrument to enhance comprehension of the population's characteristics and to discern the urban areas most susceptible to social, economic, environmental and epidemic hazards.

Social vulnerability is defined as a condition of deprivation across multiple levels, involving different aspects of daily life and exposing the population to risks related to natural, environmental, socioeconomic and epidemic factors (Davino et al., 2021). These factors encompass job instability, unemployment, inadequate education, substandard housing conditions, overcrowding, domestic violence, chronic diseases, addictions, insufficient access to healthcare services and disabling conditions. This is a complex concept, which requires a synthetic representation through a composite index, capable of integrating a series of elementary indicators through a multidimensional approach. The seven principal dimensions that must be given full consideration for the purpose of constructing the composite index are as follows: housing conditions, social context, social relations, education, labour market, mobility and economic well-being.

The condition of vulnerability that may accompany ageing is not a marginal phenomenon, nor is it univocal. Rather, it recalls a multiplicity of complex and interconnected dimensions, involving individual, relational and contextual aspects. Indeed, the elderly person is confronted with transformations affecting both personal resources and the social and institutional environment in which they are embedded, in a process in which fragility and resilience coexist (Schröder-Butterfill and Marianti, 2006). A plethora of studies have emphasised the central role of social relationships, health and mobility, economic resources, social participation and the quality of the living environment, such as the presence of safe and perceived pleasant neighbourhoods, in the well-being of the elderly (Gabriel and Bowling, 2004).

Vulnerability in the elderly can manifest in various forms, including the fear of premature or degrading death, the absence of adequate physical and health care, the excess or intrusiveness of care, economic disadvantage, social exclusion, loneliness, loss of autonomy, the risk of institutionalisation or homelessness (Schröder-Butterfill and Marianti, 2006). A considerable number of studies have sought to quantify social vulnerability by constructing composite indices. However, the majority of existing indices have been developed for the general population, with only a small number having been designed specifically for the elderly population (Chau et al., 2014).

How to Measure Age-Friendliness and Sustainable and Inclusive Well-Being

In recent years, the reflection on social vulnerability has broadened, moving away from the analysis of structural disadvantage or exposure to critical factors alone towards a more articulated assessment of the extent to which the urban environment favours active, autonomous and healthy ageing.

In this perspective, the studies adopt the age-friendliness paradigm, as promoted by the work of the World Health Organisation (WHO, 2015). These studies aim to assess the extent to which cities are able to respond to the specific needs of the elderly population. Consequently, the emphasis has transitioned from the mere identification of vulnerability to the evaluation of inclusivity within urban contexts. This shift in focus entails the consideration of factors such as accessibility, engagement, subjective well-being, and social cohesion. In the initial document disseminated by the WHO, a methodological framework is proposed for the assessment of urban areas' capacity to cater to the requirements of the ageing demographic. The objective of this study is twofold.

Firstly, it seeks to monitor the implementation of policies inspired by the age-friendliness paradigm. Secondly, it aims to offer a practical tool to support local governments, practitioners and communities in improving the quality of life in urban settings. The system is predicated on a structured set of core indicators, with the potential for supplementation by additional indicators, depending on the local context.

The indicators are divided into three main thematic areas: the first is the accessibility of the physical environment, which includes variables such as the presence and condition of pavements, the availability of public transport and its accessibility, the accessibility of public buildings and the cost of housing in relation to the income of the elderly. Secondly, the inclusiveness of the social environment is considered, with aspects such as participation, perceived respect, involvement in decision-making processes, economic security and access to social welfare services being taken into account. The final component pertains to the impact on the quality of life, in terms of well-being and perceived health. These three dimensions are complemented by equity indicators that detect inequalities between groups of older people according to age, gender, income, geographical area or level of education. The construction of the indicators is based on two main sources of information: local administrative data and surveys on the elderly population. The latter are also useful in capturing the subjective component, such as satisfaction with services and perception of safety. The integration of objective data and subjective perceptions is a key strength of the proposed model. The primary benefits of this approach are threefold. Firstly, it enables the comparison of areas within the same city. Secondly, it facilitates the monitoring of the evolution of age-friendliness over time. Thirdly, it identifies local criticalities.

The interest in more articulated measurement tools is not limited to vulnerability and age-friendliness but extends to the broader concept of sustainable and inclusive well-being, as demonstrated by the growing number of studies that, since the report by Sen, Stiglitz and Fitoussi (2009), have contributed to the development of multidimensional indices. These approaches seek to circumvent the limitations of conventional economic measures by incorporating social, environmental and territorial dimensions, whilst concomitantly focusing on spatial phenomena, local inequalities and interconnections between geographical areas.

The CASA Project

It is from these premises that the CASA (Aging in Cities-Medium: How Housing Conditions and Urban Spaces Can Reduce or Increase Opportunities for Longevity in Health) project was developed, a programme funded by the Next Generation EU initiative. progetto finanziato da Next Generation EU.

The CASA project is an academic initiative that aims to enhance the understanding of the multifaceted dimensions of housing and urban vulnerability in medium-sized Italian cities. A key objective of the project is to analyse the relationship between urban characteristics and the trajectories of potential ageing in senior citizens. The research adopts a case study approach, focusing on the Municipality of Bergamo as a model example. This municipality is notable for its clearly defined spatial, social and institutional characteristics, which serve as a benchmark for understanding urban dynamics. It is regarded as a prototypical "average city," offering a useful framework for developing analytical and interpretative models that can be applied to a range of urban contexts.

The project identifies a series of socio-economic, socio-demographic and spatial indicators, both at urban and suburban (district) level, referring to the case study of Bergamo. The initial phase of the project entailed the integration of various databases, including municipal ISTAT data, hospitalisation data from the Ministry of Health, and municipal data, among others. A survey is being conducted among the elderly population residing in the municipality, with the aim of understanding the motivations and factors that have influenced their selection of living places for their ageing process. In order to analyse the settlement characteristics of the municipal context and the spatial organisation of the neighbourhoods, reference is being made, above all, to municipal and regional level databases (Open Data and the Geoportal of the Lombardy Region), given the level of detail to be guaranteed. Other national and European sources may be utilised to support and supplement the analysis. These explorations are conducted with the aim of dealing with different thematic levels (e.g. main functions of the building fabric, organisation of public spaces and equipment, mobility networks, ecological-environmental

system) both in order to recognise the characterising elements and conditions of the Municipality of Bergamo, as a city taken as an ideal type and territorial model of reference, and to identify the specific features of each district treated. In the recognition of the settlement characteristics of the spatial areas under analysis, particular attention is paid to the elements and conditions responsible for the worsening of conditions of vulnerability towards the elderly population.

In accordance with the theoretical framework delineated above, a number of key elements for analysis are identified. The factors associated with housing vulnerability can be categorised into three distinct groups: structural factors, which include characteristics such as dwelling size, age, isolation, and security; access to services, which encompasses amenities such as pharmacies, parks, meeting centres, and public transport; and the interplay between vulnerability factors and well-being, encompassing aspects such as psychophysical health and longevity. The spatial analysis is divided into two complementary elements. Firstly, the municipal focus analyses municipal data, demographic and housing-urban variability, and identifies synthetic indicators of vulnerability. Secondly, the focus at the detailed geographical unit is based on the scale of the 22 neighbourhoods of the municipality of Bergamo (Figure 1). Here, the indicators are refined, recording aspects of housing-structural type and access to services and risk conditions. As anticipated, ground temperatures (Figure 2) and ecosystem services (Figure 3) are considered at the neighbourhood scale.

The CASA project aims to achieve an in-depth understanding of the conditions and needs that older persons have in relation to the places where they live and how this relationship may determine longevity in health in average Italian cities. The result of the research will be the production of vulnerability indicators for individuals who experience ageing in their living places on a daily basis. These indicators and their relationship to health will be used to inform elderly people and policy makers with a view to proposing innovative Aging in Place policies.

Figure 1: Three analytical maps of the neighbourhood (infrastructural, settlement and environmental system). a. Infrastructure system: this map illustrates the main mobility and connection infrastructures in the neighbourhood: the main roads and connecting axes are highlighted in dark red, such as roundabouts and strategic crossroads, and the connection with the railway network and suburban roads is also highlighted, indicating the overall accessibility of the area. Infrastructure has a significant impact on the neighbourhood, creating numerous caesuras. b. Settlement system: represents the organisation of the built-up area in the neighbourhood in which densely built-up areas (residential and productive) are shown in dark grey; low-density areas (such as scattered housing or recent expansion) are in light grey. Urban voids, unbuilt areas and residual spaces are noted, which are fundamental for possible urban regeneration strategies. c. Environmental system: map dedicated to natural and environmental elements to highlight ecological corridors and linear vegetation along infrastructures, which play a relevant ecological and landscape role.

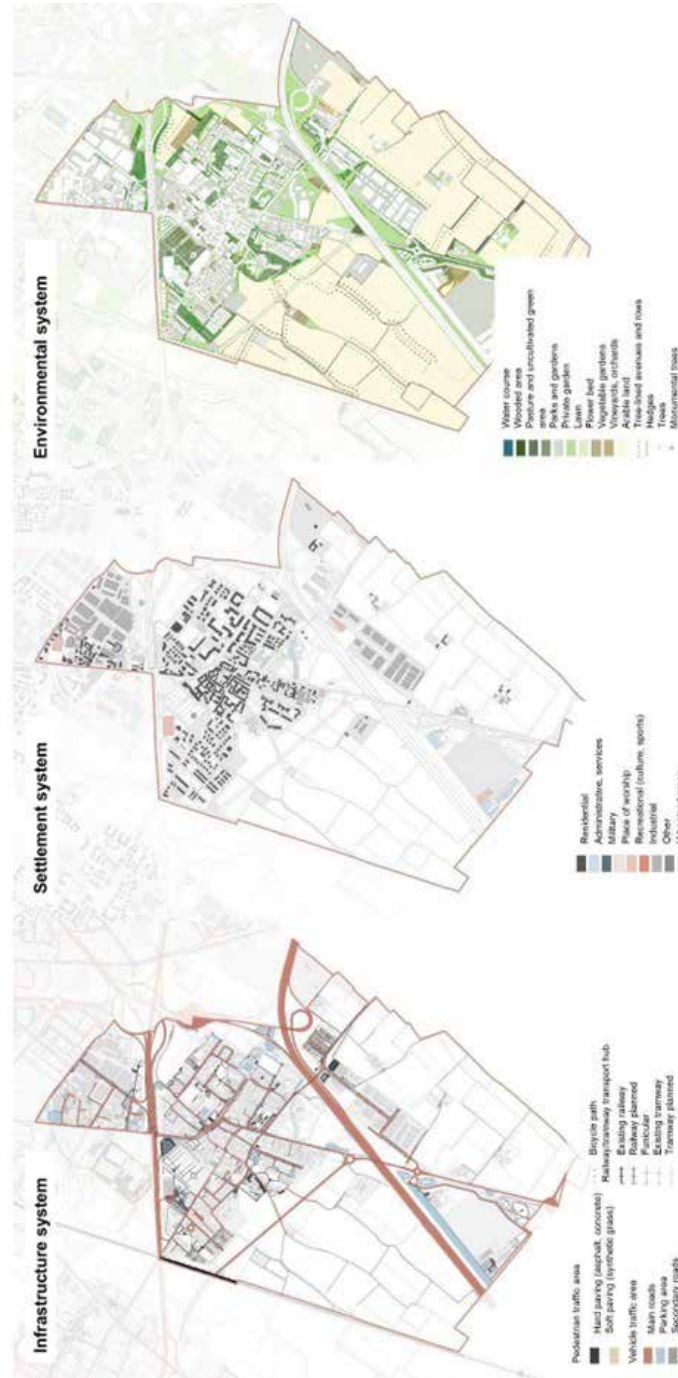


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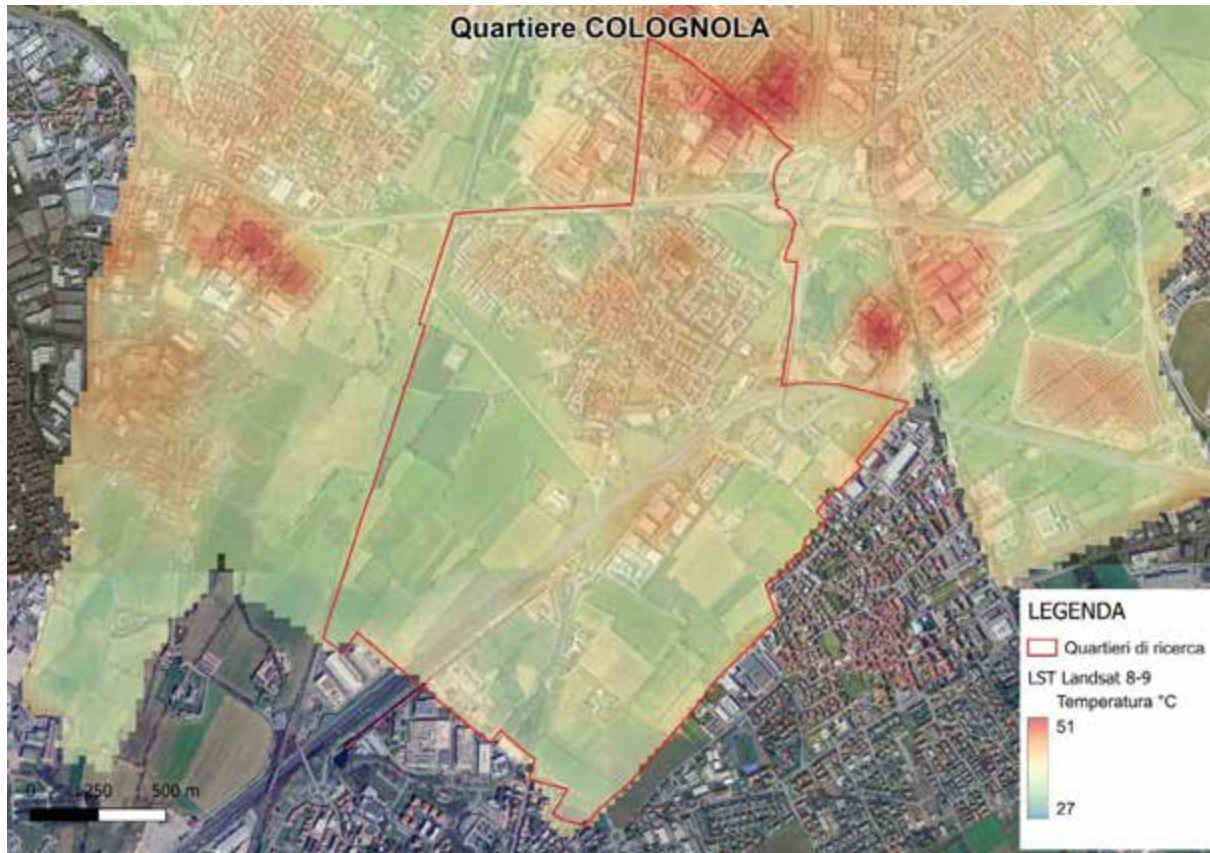


Figure 2: This map depicts the distribution of the ground surface temperature in the Colognola district: the red areas reach high temperatures (up to 51°C), typical of asphalt surfaces, industrial areas and compact urbanisation, which are subject to the heat island effect. The yellow/orange zones indicate intermediate temperatures, often associated with mixed surfaces of buildings and vegetation. The blue areas are the coolest (around 27°C), often coinciding with green areas, parks or agricultural fields. This map makes it possible to assess the critical climatic conditions in the neighbourhood and suggests the importance of mitigation measures through an increase in green areas.

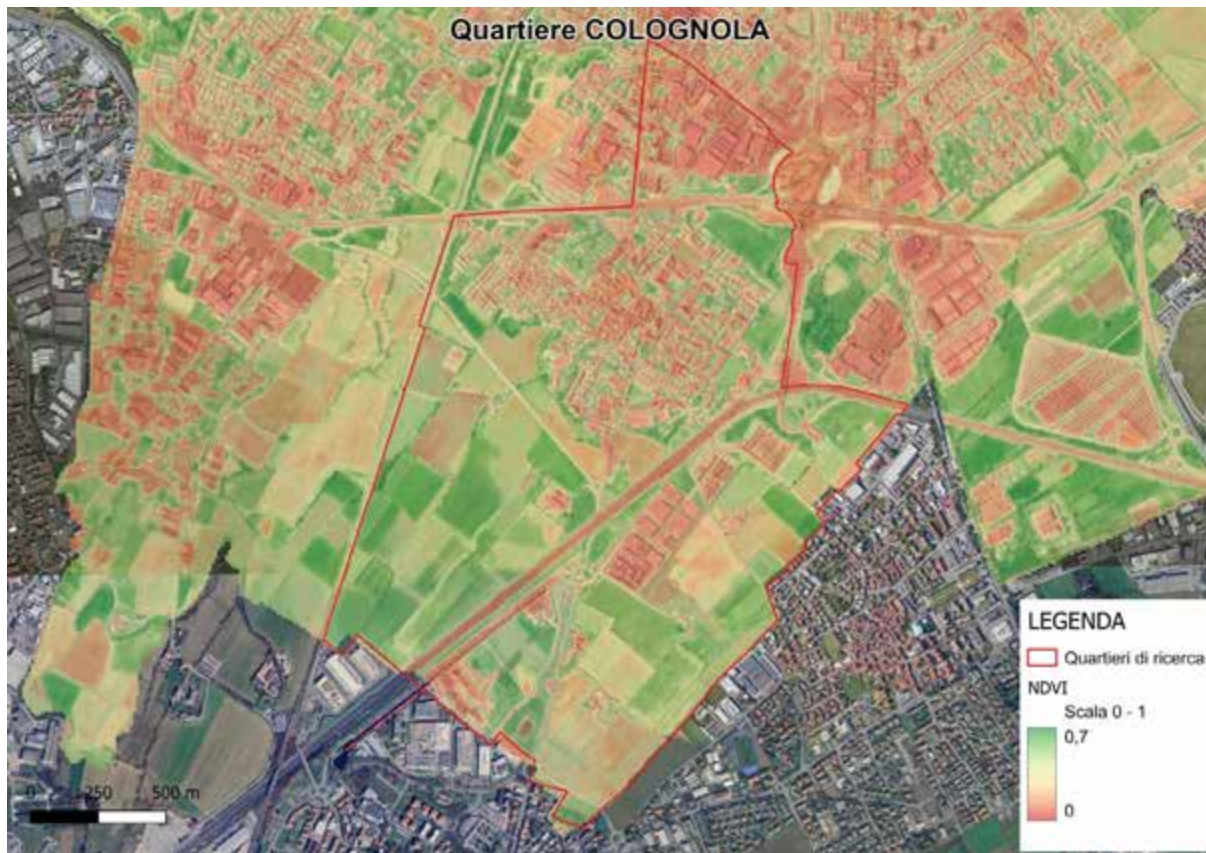


Figure 3: The map shows the vegetation vigour index in the Colognola district. The NDVI varies from 0 to 0.7, where dark green areas indicate lush and healthy vegetation, typical of parks, active agricultural areas or wooded areas; red areas show heavily urbanised or sealed areas, lacking significant vegetation (NDVI $\approx$ 0); intermediate shades (yellow/orange) represent medium vegetation, such as gardens, hedges or scattered trees.

Conclusion

The rapid ageing of the global population highlights the importance of urban planning and the built environment in promoting healthy ageing. Environmental factors significantly impact the health of the elderly, demonstrating the potential of spatial planning interventions to prevent disease and promote healthy ageing. Italy is experiencing rapid demographic change, particularly in cities, and the organisation of urban environments influences the daily lives and well-being of its population. Public spaces play a key role in this respect, either favouring or hindering the mobility and social engagement of elderly populations.

This paper outlines the initial stage of the CASA project, which examines how urban spaces impact healthy ageing and neighbourhood attachment in medium-sized Italian cities, using Bergamo as a case study. The research aims to understand the impact of urban structure and environments on elderly people, focusing on the effectiveness of public spaces in promoting health and social inclusion while identifying barriers to their use and recognising neighbourhood heterogeneity.

'Ageing in place' is considered in the context of climate change, which poses significant health risks for older people due to rising temperatures and extreme weather conditions. Urban greenery and nature-based solutions (NBS) are vital for encouraging physical activity, social interaction, and mental well-being, particularly in low-income areas. Walkability is vital for the independence and health of older people, yet rising temperatures and the urban heat island effect can hinder outdoor activity and social interaction. Therefore, urban design interventions are essential to improve thermal comfort and accessibility.

A key concept in this research is environmental vulnerability, which describes territories' susceptibility to environmental and social changes. This is often exacerbated by urban planning that neglects the needs of vulnerable populations, inevitably leading to inequalities. This includes individual vulnerabilities (e.g. declining health and social isolation), economic vulnerability (e.g. lack of financial resources) and social/relational vulnerability (e.g. loss of social connections), all of which can be exacerbated by environmental factors. Social vulnerability is measured using an index incorporating factors such as housing, social background, education and economic well-being.

Rather than simply identifying vulnerability, the research assesses urban inclusiveness for active, autonomous and healthy ageing, in line with the WHO's friendly age paradigm. This involves assessing accessibility, engagement, subjective well-being and social cohesion using a framework of indicators and local administrative data, supplemented by surveys of elderly people to obtain objective and subjective perceptions.

Based on these principles, the CASA project aims to gain an in-depth understanding of the conditions and needs of elderly people in relation to where they live, and how this affects their longevity and health in Italian cities. By integrating different databases and conducting surveys in Bergamo, the project identifies socio-economic, socio-demographic and spatial indicators at the urban and neighbourhood levels, focusing on factors that exacerbate vulnerability. Ultimately, the research will produce vulnerability indicators for the elderly, providing crucial information for both this demographic and policymakers to develop innovative 'ageing in place' strategies.

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