

Article

The 15-Minute City: An Attempt to Measure Proximity to Urban Services in Rome

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Abstract: This paper aims to assess the proximity of urban services through the lens of the 15 min city concept, using the Municipality of Rome as a case study. The question of whether Rome qualifies as a 15 min city is explored by examining proximity in terms of the “intensity” of urban services accessible within a 15 min walking or cycling distance. A simple model, based on GIS techniques, is implemented to measure proximity to urban services at the neighbourhood level. Furthermore, the proximity levels in urban areas characterised by similar socioeconomic conditions, referred to as the “seven cities” of Rome, are analysed to identify potential inequalities. Our analysis shows that the dense and walkable Rome known by tourists is not the place most Romans live in.

Keywords: 15 min city; proximity; inequalities; mapping; Rome

1. Introduction

Life in large cities has become increasingly complex and frenetic. The physical and functional complexity of urban spaces, and the long distances between places of residence and places of work, study, leisure, and so on, deeply affect our quality of life. This simple observation forms the basis for Carlos Moreno’s proposal of the “ville du quart d’heure”, the “15-min city”. According to its author, “the 15-min city embraces the concept of ‘chrono-urbanism’, which contrasts the level of quality of life with the time spent commuting each day, especially by car” [1]. It represents the opportunity for residents to access all the essential services within a 15 min walk or cycle, rather than being forced to face traffic-clogged roads and long commutes that reduce their free time. Other authors, such as Weng et al. [2] and Capasso Da Silva et al. [3], have built on this idea, highlighting the importance of the accessibility of urban services through soft or pedestrian mobility and its positive effects on both ecological sustainability and social interactions among citizens.

Changing lifestyles in line with the goals of environmental, social, and economic sustainability has long been recognized as a necessity, including at the political level. This issue became compelling after the 2020 COVID-19 pandemic crisis, which fuelled the public debate on sustainable cities and proximity to services whilst shifting towards remote work. In this context, the 15 min city can be considered a way to approach sustainability goals in urban areas. But what should its priorities be? Better proximity to all services could return urban spaces—currently taken over by motorized traffic—back to citizens. To pursue such an objective, city administrators should look at the city not only through the lens of architects or urban planners but also involving other social disciplines that can help understand the city’s multidimensional, dynamic, and highly complex nature. For this reason, our focus is on proximity to multi-level and multi-function services, considered a key element to reduce pollution and traveling times, and to improve the citizen’s quality of life.

The 15 min city approach has indeed transcended the merely academic boundaries. Many cities around the world—e.g., Paris [4,5], Barcelona [6], Bogotá [7], Buenos Aires [8,9],



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Portland [10,11], Melbourne [12]—have now implemented policies related to proximity to and accessibility of urban services. Recently, the city of Rome has also adopted a 15 min city approach inspired by the work previously performed in Paris [13].

These efforts can be easily framed within some large-scale international initiatives committed to address problems such as climate change, unsustainable growth, and rising inequalities. The C40 network of the world's cities can be mentioned, with the “C40 Mayors' Agenda for a Green and Just Recovery”, which emphasised the need to create the conditions for inclusive and equitable cities, especially environmentally healthy living and good citizen services [14–16]. Another significant initiative is the “New Urban Agenda” promoted by UN-Habitat, which acknowledges proximity as an essential condition for sustainable urban development. This document was subscribed to by 193 countries in the frame of the United Nations Conference on Housing and Sustainable Urban Development in Quito [17,18]. Most importantly, the “2030 Agenda for Sustainable Development”—Goal 11 on sustainable cities and communities pursues a vision of inclusive, safe, resilient, equal and sustainable cities and human settlements, supported by integrated planning and equitable access to basic services for the benefit of all residents [19].

The 15 min city represents a viable path towards sustainable development (SD) objectives, proposing a human-centred urban development with ecology, proximity, solidarity and participation as fundamental principles [20]. In this paper, we explore the proximity to urban services, which is one of the principles of the 15 min city on which the citizen's quality of life depends [21]. We analyse the municipal territory of Rome, Italy, one of Southern Europe's largest cities. Among the—frequently debated—problems of Rome, growing inequalities is probably one of the most overlooked. As is the case for many other big cities, Rome is highly unequal in terms of the opportunities offered to its citizens. The capacity of people to achieve personal fulfilment by widening their individual choices is strongly conditioned by the uneven socioeconomic development. Forms of territorial discrimination are not only evident in income differences but, more importantly, in the access to services, which often leads to deepening inequalities [22]. For example, not having a nearby daycare can result in the decision to quit work to take care of a child—a choice that almost always falls on women. For this reason, the concept of the “15-min city”, with its “proximity revolution” becomes a key element in contrasting socio-spatial inequalities. And this is why, when studying inequalities in Rome, it is crucial to examine the distribution of services within the 15 min city.

This paper is organized as follows: section two describes the evolution of the 15 min city concept; section three explores the concept of proximity to urban services; section four describes the study area; section five illustrates the methodology; section six discusses the results; and section seven contains some final remarks.

2. The 15 Min City: Concept Evolution

The concept of the 15 min city began to gain worldwide notoriety in 2020 when the Mayor of Paris, Anne Hidalgo, decided to undertake a true proximity revolution with the collaboration of urban planner Carlos Moreno, creator of the 15 min city concept. The idea was quite simple in some ways: a model of sustainable urban development that placed the human being at the centre of city planning, embracing the notion of chrono-urbanism [1,23].

The 15 min city model stands out in clear opposition to Le Corbusier's Athens Charter (1933), which has been the foundation for urban development over the past ninety years. The Athens Charter introduced the principle of “zoning”, proposing a very rigid division of urban areas, each with a specific function: working and producing, living, recreation, and so on. In contrast to this idea, the 15 min city envisions reduced distances for shorter commutes: an inclusive transformation that places people and their needs at the centre [24–28]. But the roots of the 15 min city model are well established in the past and there are several precursors who anticipated some of its elements. In 1898, E. Howard addressed the overcrowding problem with the Garden City solution, envisaging an urban system provided with autonomous services [29]. In 1929, C. Perry introduced the concept

of the Neighbourhood Unit to regulate the spatial organisation of the city: each Neighbourhood Unit was to be equipped with the necessary urban services, such as schools, retail services, community centres, green areas and public spaces [30]. In 1961, J. Jacobs published “The Death and Life of Great American Cities” and explained how proximity was vital for people to exchange ideas, goods, beliefs and knowledge, generating diversity [31]. During the 1980s and the early 1990s, the New Urbanism movement proposed compact developments featuring mixed uses, integrating various housing types and encouraging sustainable transportation options to achieve human-scale neighbourhoods [32]. Transit-Oriented Development, developed in the 1990s with P. Calthorpe’s “The next American metropolis”, proposed reorganising cities around public transportation, seeking more pedestrianisation and more sustainable mobility with less private car use [33]. Another inspiring idea was the “Metapolis” of F. Ascher presented in his work “Métapolis: ou l’avenir des villes”, where he argued that urban areas operate as connected networks, facilitated by transportation and telecommunication systems [34]. A significant contribution came from J. Lerner in 2003, with “Urban Acupuncture”, which emphasized the importance of public ownership of urban spaces and the value of small projects that can be implemented quickly, thereby creating chain effects [35]. In 2010, M. Casagrande undertook a similar work, highlighting the critical role of community involvement in contrast to large-scale urban renewal initiatives [36].

Density, diversity, proximity and digitalisation are the pillars on which the functioning of the 15 min city rests. With these ingredients, neighbourhoods do not provide specific activities but offer all the opportunities and services citizens need to lead a dignified life, offering amenities where there are none, including every social group, starting with the most marginalised and disadvantaged [37]. In his model, C. Moreno considers that services belong to six “Urban Social Functions” (USFs), categories including the necessary amenities to lead a dignified life in an urban context: caring, enjoying, learning, living, working and supplying. The USF services should be accessible within a 15 min walking or cycling distance from home [1].

3. Proximity to Urban Amenities, Inequality and Quality of Life

The 15 min city model advocates for sustainable urban development based on proximity to urban services. Proximity is one of the principles governing the functioning and evolution of cities since the organisation of urban space and its components depends on it. To increase proximity, barriers imposed on the movement of people and the exchange of goods, services and information must be overcome: the higher the proximity level, the more factors of production are available for economic activities and the lower the costs of obtaining goods and services [38]. With reference to the urban space, the possibility of using a certain service depends on the capacity to reach that service. This can be described in terms of proximity, understood in the sense of both distance travelled and time spent doing so, which is one of the mainstays of the 15 min city, a fundamental aspect to contrast the growing inequalities and to improve the quality of life for everyone [39,40].

Indeed, the geographical location of urban services and amenities can affect people’s quality of life and well-being [41–43]. Proximity, together with the efficient use of resources, makes it possible to plan cities while pursuing the objectives of sustainable urban development and reducing socio-spatial inequalities [44].

Several case studies already exist, focusing on the 15 min city. An analysis conducted for Naples considers geomorphological, physical and socioeconomic characteristics to detect the parts of the urban area that can be defined according to the 15 min city [45]. Case studies in Cagliari, Perugia, Pisa and Trieste assess urban systems’ alignment with the 15 min city concept, focusing on reproducible and comparable indicators of density, proximity, diversity and service access [46]. For an evaluation of the city of Vancouver, a cumulative opportunity measure is used to quantify the availability of grocery stores reachable within a 15 min walking or cycling distance from residents’ homes, accounting for varying travel speeds to assess the proximity for different age groups of people [47]. By

dividing the territory of Rome into hexagonal zones with a diameter of 1250 m, the distance from the centre of each zone to various services, classified into categories and subcategories, is calculated, obtaining a service proximity indicator, with the scores ranging from 100 to 20 (100 for distances within 500 m, 80 within 1000 m, 60 within 2000 m, 40 within 4000 m, and 20 beyond); these scores are then weighted and aggregated for each pillar on the basis of the sustainability and importance of the services, prioritizing essential services [48]. Another study compares Rome, London and Paris by calculating pedestrian travel times to access services for all possible routes [49]. For the city of Barcelona, utilizing cadastral parcels, the network analysis method is used for services and activities, according to the canons indicated by Moreno's model [50]. A study in the city of Turin proposes a proximity analysis using three time thresholds (5, 10 and 15 min), considering the zones of the city and the percentage of the population [51]. A 15 min city index is proposed to understand the status of Hong Kong by fitting the proximity measured by the modified two-step floating catchment area method to categories related to the dimensions of living, health, education, public transit and entertainment [52]. With the aim of being reproducible everywhere using global open data, the NExt ProXimity Index measures proximity on foot in the cities of Bologna and Ferrara, representing the values on a local scale with hexagonal grids [53]. A comparison in terms of the 15 min walking proximity between various European cities of at least 100,000 inhabitants is carried out by considering the total destinations and types of opportunities as indicators, highlighting inter- and intra-city inequalities with the computation of pseudo-Gini coefficients [54].

Since 2021, with the election of Roberto Gualtieri as Mayor of Rome, the municipality has been planning its urban development from the perspective of Moreno's 15 min city, conceiving Rome as a polycentric, accessible and sustainable city in which citizens find an extensive network of neighbourhood services available at a maximum distance of 15 min on foot and by bicycle [55].

4. The “Seven Cities” of Rome

Rome is the most populated Italian city, with more than 2.8 million people, and the country's largest municipal territory, measuring 1287 km² [55]. The area within the ancient city walls is recognised by UNESCO as a World Heritage Site for its outstanding universal value [56–58]. Rome is nevertheless affected by strong socioeconomic divides and growing inequalities [59,60] fuelled by an incessant urbanisation process often rooted in speculative practices [61,62]. Polarisations are clearly visible in terms of health, education, employment and income [59,63]. A monocentric, over-bounded urban structure, recalling in some ways E. Burgess's Concentric Zones [64], is the result of different phases of expansion from the late 19th century. Peripheral areas are often spatially isolated, distant from the city's social, cultural and political life, and characterised by a lack of services, urban amenities, and public spaces.

According to Lelo, Monni and Tomassi [22], it is possible to identify “Seven cities” within Rome. Six of these are clearly distinguishable urban regions in terms of the physical and socioeconomic characteristics, which we include in our analysis (Figure 1). Not considered here is the seventh city of the “invisibles”, which cannot be measured through reliable statistical sources since it represents temporary indigent populations (homeless, squatters, migrants, and so on) [22].

The Historical City is associated, to the point of cliché, with Rome itself. It encompasses the ancient city within the Aurelian walls, an area with less than 100,000 residents, which represents only one percent of the municipal territory, visited every year by millions of tourists and pilgrims. Residents are constantly decreasing because a high share of real estate is used for short-term rentals and office spaces [65,66]. Many of the residents are single and elderly individuals, and there is a comparatively high share of foreigners. This area has the best public transport system (bus and tram frequency is high, proximity to metro and railway stations is good) and offers a wide range of educational facilities (from preschools to high schools, but excluding nurseries), cultural amenities (cinemas, theatres,

libraries), and commercial services (local shops, bars, restaurants, craftspeople, banks, and even some large retail chains). Additionally, it has an abundance of public squares, which serve as meeting places for residents, as well as volunteer associations, senior centres, and churches.

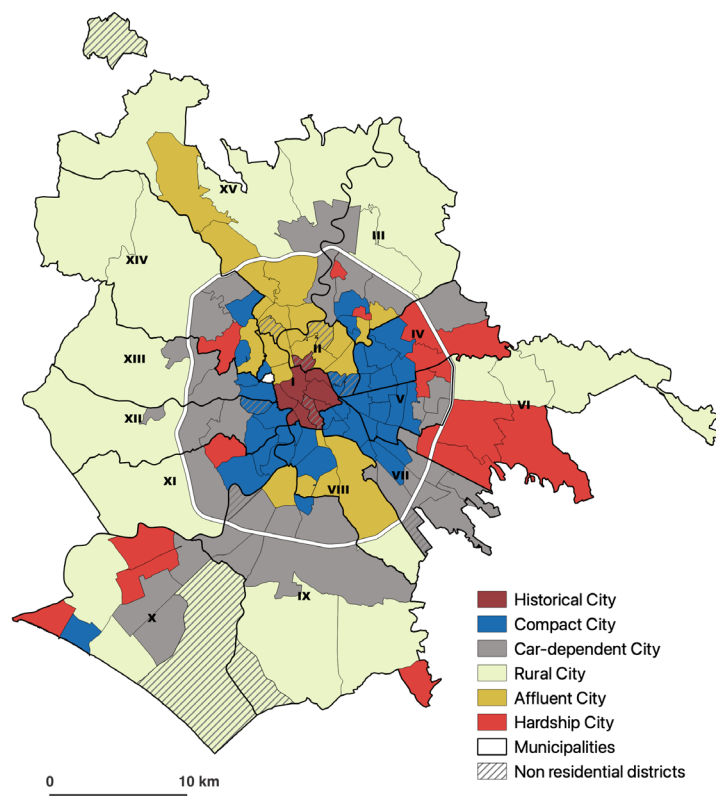


Figure 1. Socio-spatial characteristics of Rome [22].

Contiguous to the Historical City there is an intensive belt of neighbourhoods built during the first half of the 20th century, known as the “historical” periphery or Compact City. With more than one million residents, this is the most densely inhabited part of the city, characterized by a scarce presence of green areas and a poor quality of buildings and public spaces, on the one hand, but a good provision of public transportation and services, and plenty of spaces and opportunities for social interaction, on the other [67]. The educational offer (from nurseries to high schools) and commercial services (local shops, craftspeople, and large retail chains, but not bars and restaurants) slightly exceed the Roman average, while the cultural offer (cinemas, theatres, libraries) and senior centres are below average. There are many public squares, both in absolute numbers and relative to the density, and people can easily and safely walk or cycle, without needing to drive. Moreover, the proximity to metro and railway stations is the most favourable in Rome, with 77.5% of residents living within a 10 min walk from a stop.

The “new” peripheries developed during the second half of the 20th century beyond the Compact City, along the city’s ring road (Grande Raccordo Anulare—GRA) and highways, are labelled as the Car-dependent City due to the need to use private transportation for most of the trips [68]. These areas count about 610,000 residents and the population is progressively increasing. Residents are younger than the Roman average, with a good employment rate and a smaller share of foreigners. This area is very fragmented in terms of the urban structure, with residential, business, and commercial districts physically separated from each other, making it almost entirely reliant on private vehicles for commuting, study or leisure. The lack of social spaces (squares, shops, playgrounds) is compensated for by the presence of large shopping centres and retail chains, the only gathering places in these suburbs. The nursery and preschool availability is above the Roman average, but the

rest of the educational, cultural, commercial, and bank services are below average. About public transport, while the bus frequencies are similar to the Roman average, the distance from metro and railway stations is very high, as only 19% of residents live within a 10 min walk from a rail stop.

Beyond the peripheries extends Rome's historical agricultural region (Agro romano), labelled as the Rural City. In these areas, urban sprawl is taking place, causing a rapid increase in residents by 80% since 2002. These fast-growing, recent peripheries surrounded by agricultural land and large parks suffer from the almost complete lack of shops and services of all kinds, transportation services and urban amenities [69]. The 180,000 residents living in these areas are typically younger, and families are typically larger than the Roman average. The educational offer (from nurseries to high schools), cultural amenities, commercial services, and banks are extremely low and well below any other part of the city; sports and healthcare facilities are also scarce. However, senior centres and large retail chains exceed the Roman average. Here, too, squares are few, making social interactions infrequent, while metro and railway stations are far away and largely inaccessible, with only 6% of residents living within a 10 min walk from a rail stop.

The linearity of this scheme, Historical City—Compact City—Car-dependent City—Rural City, appears in many cases overwhelmed by other, distinctive urban features, determined by the location choices of opposite social groups. Rich neighbourhoods can be found in different semi-central areas located northwest and south of the historic centre. With about 440,000 residents, the Affluent City is characterised by the presence of highly qualified professionals, lower unemployment rates, and higher housing quality, but public services are often limited, especially in neighbourhoods distant from the city centre. Although it does not reach the same concentrations as the Historic City, it still offers above-average educational services, cultural amenities, commercial services, and banks, while senior centres are below average. Regarding public transportation, the bus and tram frequencies exceed the Roman average, especially in the EUR directional district, but the proximity to metro and railway stations is slightly lower.

Oddly, poor neighbourhoods also host about 440,000 residents. The Hardship City is located mostly in the outskirts, characterised by both informal areas (borgate) and large complexes of public housing [70–72]. Poverty, low education levels, unemployment, and health problems are very frequent in these areas. The family size is on average larger than elsewhere, the shares of young people and foreigners are higher, and the average living space is smaller. The educational offer, from nurseries to middle schools, is slightly below the Roman average, while the high school availability is half of the citywide average. Cultural amenities, commercial services, and banks are significantly below the average, while large retail chains and senior centres are slightly above the Roman average. Public squares are scarce, especially in neighbourhoods that originated as informal settlements, where even sidewalks and bike paths are non-existent, so that walking or cycling is difficult and unsafe. Public transport is poor, with few bus and tram lines, and metro or railway access is below the Roman average.

At the administrative level, Rome is organised into 15 Districts (Municipi). For statistical purposes, the municipal territory is subdivided into 155 urban areas (Zone Urbanistiche—ZUs) that are the reference for urban planning and management activities (some ZUs are scarcely inhabited and characterised by the presence of parks, services or archaeological sites; these are referred to as “non-residential”) (Appendix A). Figure 1 illustrates the above-described socio-spatial characteristics of Rome through a thematic classification of the ZUs in the six “cities”. We continue our analysis by defining and applying a proximity model for Rome at the ZU level and, further on, by discussing the results for the different urban contexts (cities).

5. Methodology

The methods of proximity analysis briefly discussed in Section 3 generally follow a “from the user—to the service” paradigm. The distances from arbitrarily defined focal

points (census tracts or hexagon centroids, road intersections, ...) are drawn—often accounting for the pathways—to connect presumed catchment areas to services distributed in space. These rather complex methodologies include the acquisition and manipulation of large datasets from different sources [45–54]. The multiple parameters required by the model to guarantee the quality of the information often face the need for simplification and the risk of producing spatially inconsistent outputs. In many cases, the results, although graphically appealing, may be of limited use for decision-makers since the proximity level does not refer to official administrative subdivisions.

Our methodology proposes a different approach, concentrating on service intensity, suggesting an original index at the neighbourhood level, which we discuss in detail in this section. The advantage of our approach lies in its simplicity, which returns a good level of reliability, and in its incremental nature; it can be further refined to account for the presence of physical barriers, walkability characteristics, walking or biking speed, differences among services and so on.

Inspired by the 15 min city model, we select and analyse different urban services categorised according to the scheme of the “Urban Social Functions” (USFs) introduced by C. Moreno. These categories are Caring and Security “C&S”; Culture and Free time “C&F”; Education and Learning “E&L”; Mobility Services “MS” and Other Proximity Services “OPS” [1,73]. The data are obtained mainly from official administrative sources, and only for a few private services are online open sources used (locations of bus stops, banks and ATMs are retrieved from Open Street maps, all the other services are provided from official administrative sources). The services are first geolocalised and subsequently they are assigned to the pertinent urban area (ZU) to create a dataset that will serve as a basis for the proximity analysis. Table 1 illustrates the type and category of the selected urban services, their average numerosity per ZU and the average number of services per 10,000 inhabitants in 2022, per ZU.

Table 1. Urban services in Rome, grouped by Urban Social Function (USF).

USF by Category	Urban Service	Source	Numerosity	Services Per 10,000 Inhabitants
Caring and Security (C&S)	Hospitals	[74]	24	0.09
	Nursing homes and clinics	[74]	76	0.27
	Pharmacies	[75]	1199	4.26
	Security facilities	[74]	232	0.82
Culture and Free Time (C&FT)	Cinemas, theatres, music halls		82	0.29
	Libraries		46	0.16
	Gardens, parks and villas	[74]	64	0.23
	Outdoor and indoor sports facilities		264	0.94
	Places of worship		305	1.08
	Senior centres		105	0.37
Education and Learning (E&L)	Kindergartens		421	1.50
	Preschools		544	1.93
	Primary schools	[74]	531	1.89
	Secondary schools		314	1.12
	High schools		371	1.32
	Universities		108	0.38
Mobility Services (MS)	Metro and railway stations	[76]	142	0.50
	Bus stops	[77]	8366	29.73
Other Proximity Services (OPS)	Local authorities	[74]	51	0.18
	Banks	[78]	372	1.32
	ATMs	[79]	174	0.62
	Co-working spaces	[80]	58	0.21
	Local markets	[81]	70	0.25

Source 2. Elaboration on data by various sources.

In a recent paper, Duany and Steuteville analyse the distances that can be covered via a 15 min walk and 15 min cycle inside the city. They argue that a 15 min walk, corresponding to three-quarters of a mile or about 1.2 km, is the maximum distance that most people are willing to walk. A coverage area corresponding to a 15 min walk should include a full mix of urban services, such as grocery stores, pharmacies, general merchandise, public schools, and local public transportation facilities. A 15 min cycle, corresponding to a coverage area of a three-mile radius or about 3.8 km, should give access to major cultural, medical, and higher education facilities, regional parks and regional public transportation (Figure 2) [82].

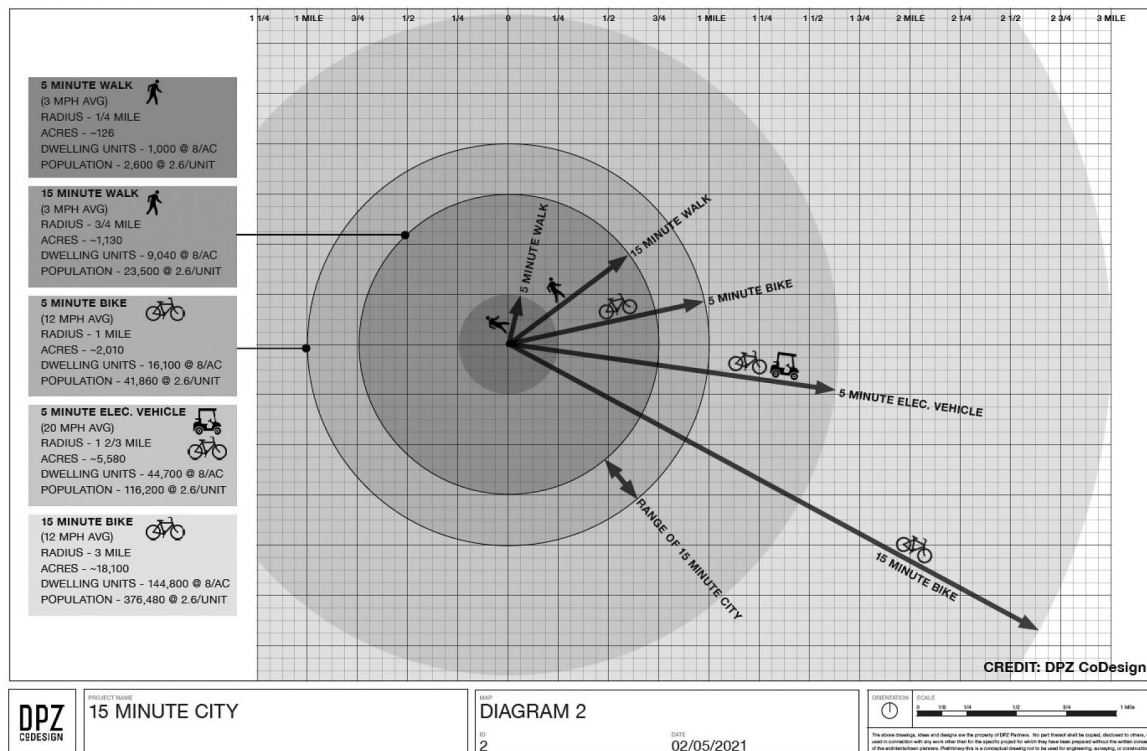


Figure 2. Distances of the 15 min city [82].

What do we mean by “proximity” to urban services? We consider as the minimum spatial unit for the proximity analysis the 155 urban areas of Rome (ZU). In our approach, the concept of proximity to urban services, measured at ZU level, has been defined in terms of the ratio between the total coverage of 15 min walking or cycling calculated from each service geographic location and the area of the spatial unit. This approach accounts for overlapping coverage areas; thus, we consider an Intensity Index as a proxy for proximity.

Selected urban services are organised in separate layers and grouped in the above-described USF categories. For each layer, from every geolocalised service, a 15 min coverage area in hectares is calculated separately for the walking and cycling distances (“buffer” function). We apply the following criteria:

- Distance covered in 15 min walk at $1.34 \text{ m/s} = 1207 \text{ m} \approx 1200 \text{ m}$
- Distance covered in 15 min cycling at $5.36 \text{ m/s} = 4828 \text{ m} \approx 4830 \text{ m}$

For each urban service, we calculate a “Service Intensity Index” SI at the ZU level as follows:

$$SI = \frac{1}{s_{ZU}} \sum_{i=1}^n a_i \quad (1)$$

where a is the portion of coverage area for a 15 min walk (or 15 min cycle) intersecting each ZU, n is the number of services within the ZU, and s_{ZU} is the area of each ZU.

For each urban service, when $SI \geq 1$, we can assume a sufficient to good proximity level for a ZU, since the total coverage area may be equal to or greater than the area of the

spatial unit; when $0 \leq SI < 1$, we can assume an insufficient proximity level since within the spatial unit there are areas uncovered by the service.

Further on, we measure a “Combined Intensity Index” (CI) for each “Urban Social Function” (USF) for the 15 min walk and the 15 min cycle, respectively, by computing the arithmetic mean of the normalised intensity indexes of the urban services included in each USF (see Table 1).

$$CI = \frac{1}{n} \sum_{i=1}^n SI_i \quad (2)$$

where SI is the normalized Service Intensity Index and n is the number of services within the USF. For each USF, the CI values range between 0 (null proximity) and 1 (maximum proximity level). We compute the 15 min CI for the 15 min walk and the 15 min cycle, respectively, for Caring and Security, Culture and Free Time, Education and Learning, Mobility Services and Other Proximity Services.

In addition, we decided to produce two “Overall Service Intensity Index” (OI) maps that consider all the services available within the 15 min walk and the 15 min cycle. The mapping outputs visually capture the overall proximity to services in the urban areas (ZU) and their spatial distribution.

In the next section, we present the results of our analysis for the municipal territory of Rome. In this regard, we would like to point out that this analysis is to be considered neither exhaustive nor complete since it adopts several highly simplifying assumptions. When defining the distance that can be covered in 15 min, the average adult is considered, excluding individuals in different conditions. We consider the urban space isotropic, not accounting for its different characteristics: road gradients, physical and architectural barriers, presence or absence of sidewalks and cycle paths, paving quality, lighting and other factors that may influence both walkability and cyclability. Furthermore, the individual preferences of citizens and their economic condition are not accounted for. Nevertheless, this analysis can be considered a first attempt to understand the nature of proximity in Rome with the criteria of the 15 min city.

6. Results

While analysing the Service Intensity Index (SI), computed as the ratio between the total 15 min walking or 15 min cycling coverage area of a service in each spatial unit and the area of the spatial unit (ZU), we observe that the number of ZU with an SI indicator considered insufficient for 15 min walking proximity is dramatically high for hospitals, high-level education services, cultural facilities in general, and services offered by local authorities. Such a result is expected, since these services are typically concentrated in a few places and not evenly distributed towards the neighbourhoods. Proximity is also low for co-working spaces and local markets, for public rail transportation, for nursing homes and clinics, while Education and Learning facilities for the age group 0–14 and pharmacies show much higher 15 min walking proximity. The SI indicator improves substantially for the 15 min cycling proximity, nevertheless maintaining similar differences amongst the services (Table 2).

While analysing the Combined Intensity Index (CI), computed as the arithmetic mean of the normalised Service Intensity Indexes of the single urban services included in each Urban Social Function (USF), we observe that the proximity levels result in average to rather low for both the 15 min walking and the 15 min cycling coverages, although singular ZUs may reach very high proximity levels, in particular for Education and Learning and Mobility Services (Table 3). It is also important to notice that the minimum value of the CI index is in all cases zero, meaning that there exist ZUs with no proximity to all the services in all the USFs. Another consideration concerns the number of ZUs positioned above the municipal average, which is rather restricted both for the 15 min walking and the 15 min cycling coverages; only for the Education and Learning 15 min walking proximity does the number of ZUs above the average reach 57% of the total (88 out of 155). In all the other

cases, the values are between 40% and 50%, with the exception of Caring and Security 15 min walking, with only 37% of ZUs having a proximity level above the average (Table 3).

Table 2. Insufficient proximity level in the ZUs by urban service.

USF by Category	Urban Service	ZU with $0 \leq SI < 1$ (%)	
		15 Min Walking	15 Min Cycling
Caring and Security (C&S)	Hospitals	91.0	29.7
	Nursing homes and clinics	56.1	20.0
	Pharmacies	19.4	0.0
	Security facilities	42.6	5.2
Culture and Free Time (C&FT)	Cinemas, theatres, music halls	73.5	22.6
	Libraries	80.0	21.9
	Gardens, parks and villas	75.5	24.5
	Outdoor and indoor sports facilities	34.2	4.5
	Places of worship	27.1	5.2
	Senior centres	75.5	8.4
Education and Learning (E&L)	Kindergartens	20.0	3.9
	Preschools	19.4	2.6
	Primary schools	19.4	1.9
	Secondary schools	29.0	2.6
	High schools	36.1	6.5
	Universities	79.4	27.7
Mobility Services (MS)	Metro and railway stations	54.8	8.4
	Bus stops	1.3	0.0
Other Proximity Services (OPS)	Local authorities	85.8	21.9
	Banks	58.7	9.7
	ATMs	40.6	6.5
	Co-working spaces	67.7	24.5
	Local markets	65.2	15.5

Source 4. Elaboration on data in Table 1.

Table 3. Combined Intensity Index for the Urban Social Functions (USFs).

USF	Average Value		Min. Value		Max. Value		S.D.		ZU Above Average	
	Walking	Cycling	Walking	Cycling	Walking	Cycling	Walking	Cycling	Walking	Cycling
C&S	0.13	0.32	0.00	0.00	0.56	0.83	0.14	0.26	58	66
C&F	0.18	0.38	0.00	0.00	0.59	0.93	0.15	0.29	68	68
E&L	0.26	0.44	0.00	0.00	0.79	0.93	0.19	0.29	88	74
MS	0.33	0.47	0.00	0.00	0.96	0.98	0.23	0.29	68	73
OPS	0.17	0.33	0.00	0.00	0.62	0.95	0.17	0.29	64	65

Source 5. Elaboration on data in Table 1.

To better understand the dynamics of proximity to urban services, we analyse the CI values in the different “cities” of Rome introduced in Section 4. First, it is obviously expected that the cycling proximity doubles compared to the walking proximity, uniformly across all the six “cities” and for all the services (Figure 3, Table 4). The patterns for the six “cities” are similar for each service, with Education and Learning more evenly distributed across neighbourhoods and Caring and Security less so, while Culture and Free time, Mobility Services, and Other Proximity services show intermediate values (Figure 3).

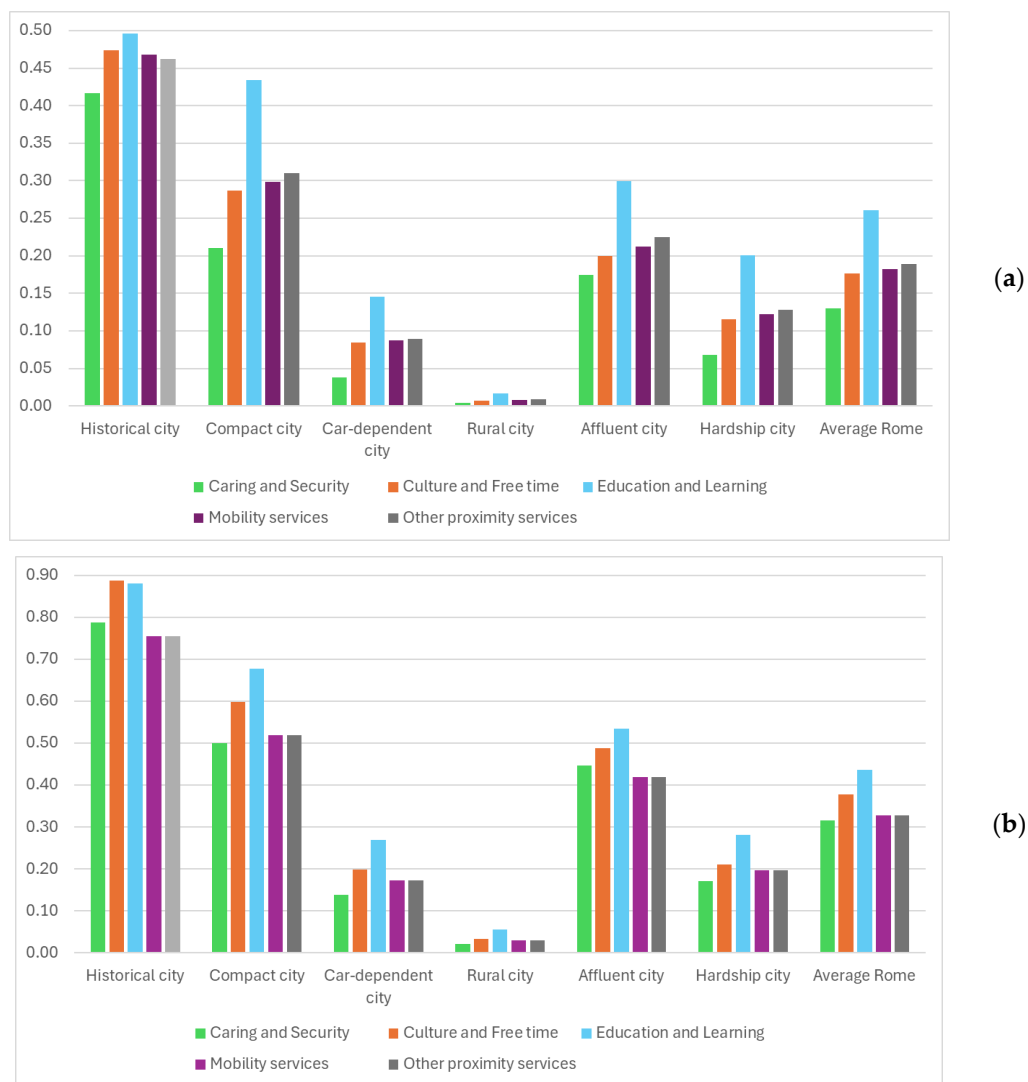


Figure 3. Combined Intensity Index for the 15 min walking (a) and the 15 min cycling (b) proximities for the different urban contexts. Source 6. Elaboration on data in Table 1.

Table 4. Combined Intensity Index for the different urban contexts.

	CI 15 Min Walking					CI 15 Min Cycling				
	C&S	C&F	E&L	OPS	MS	C&S	C&F	E&L	OPS	MS
Historical City	0.42	0.47	0.50	0.46	0.47	0.79	0.89	0.88	0.76	0.76
Compact City	0.21	0.29	0.43	0.31	0.30	0.50	0.60	0.68	0.52	0.52
Car-dependent City	0.04	0.08	0.15	0.09	0.09	0.14	0.20	0.27	0.17	0.17
Rural City	0.00	0.01	0.02	0.01	0.01	0.02	0.03	0.06	0.03	0.03
Affluent City	0.18	0.20	0.30	0.22	0.21	0.45	0.49	0.53	0.42	0.42
Hardship City	0.07	0.12	0.20	0.13	0.12	0.17	0.21	0.28	0.20	0.20
Average Rome	0.13	0.18	0.26	0.19	0.18	0.32	0.38	0.44	0.33	0.33

Source 7. Elaboration on data in Table 1.

What changes from walking to cycling mainly depends on the territorial density of the services, as some are more spatially dispersed than others and therefore already offer better coverage when walking. For example, places of worship, kindergartens, and primary schools are better distributed, even in some peripheral areas. While differentiating between the “cities”, we can observe that the Car-dependent and the Rural Cities have very low proximity levels for almost all the services, as they are also the farthest from the centre. It is

interesting to note that the Hardship City shows worse proximity levels if compared to the Affluent City, in this case also, at least in part, due to the greater distance from the centre (Table 4). Only the Historic and the Compact Cities have good proximity levels to USFs, which makes them easy to frame in terms of a 15 min city model; the remaining cities still have serious deficiencies in the services provision (Figure 4).

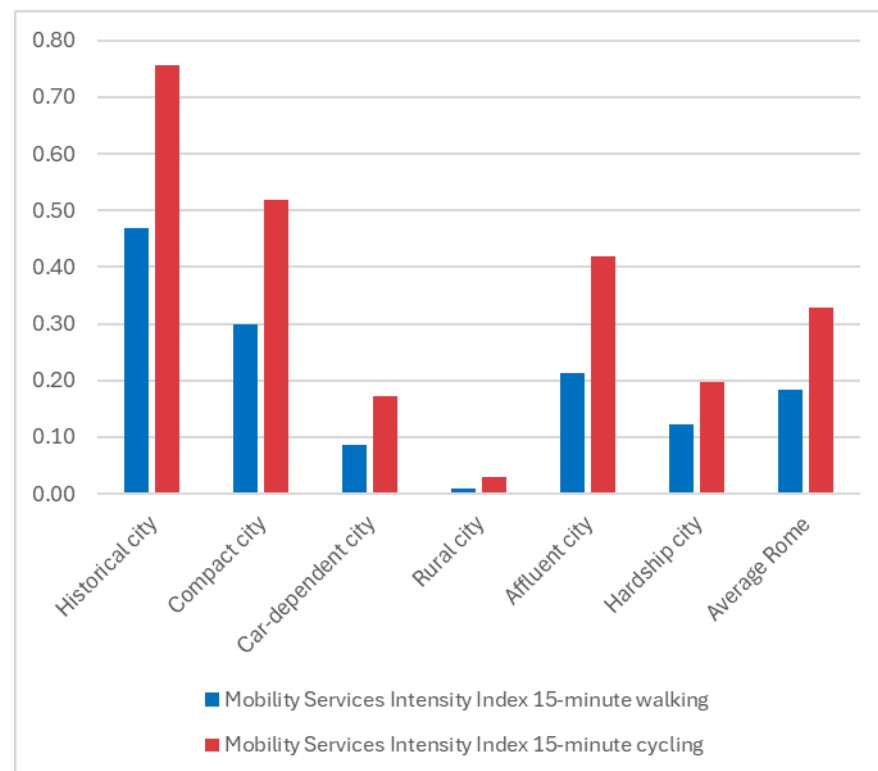


Figure 4. Proximity to urban services in terms of 15 min walking and cycling for the different urban contexts. Source 8. Own elaboration on data in Table 1.

By mapping the Overall Service Intensity Index (OI), which considers all the services available within the 15 min walk and the 15 min cycle, we visually capture the overall proximity to services in the urban areas (ZUs) and their spatial distribution.

The proximity to urban services in a 15 min walk shows the highest values in the historical centre and around the city's Central Station. Intermediate values are encountered in the dense "historical" peripheries, while areas near to the city's ring road and beyond show extremely low proximity levels. It is interesting to observe that more than half of the municipal territory is characterized by proximity levels close to zero (Figure 5). A similar scheme is revealed for proximity to urban services in a 15 min cycle, but in this case the index values are obviously higher (Figure 6).

The geography of proximity to urban services emerging from this analysis suggests relevant policy implications. As already discussed, Rome has been characterized in the last few decades by a process of expulsion of residents from the densely urbanised central areas towards distant, low-density peripheries. These complex dynamics contribute to producing the strong differences amongst urban contexts that need to be addressed by the local administration to avoid the exacerbating of socio-spatial inequalities.

This analysis would greatly benefit from further refining the methodology to account for the presence of sidewalks and bike paths, the resident habits and preferences and the differences among services. These components require in-depth knowledge and an understanding of their inter-relations to avoid distortions and arbitrariness in assigning weights. We are confident about the possibility of gaining access to a larger pool of data to improve our analysis in the future.

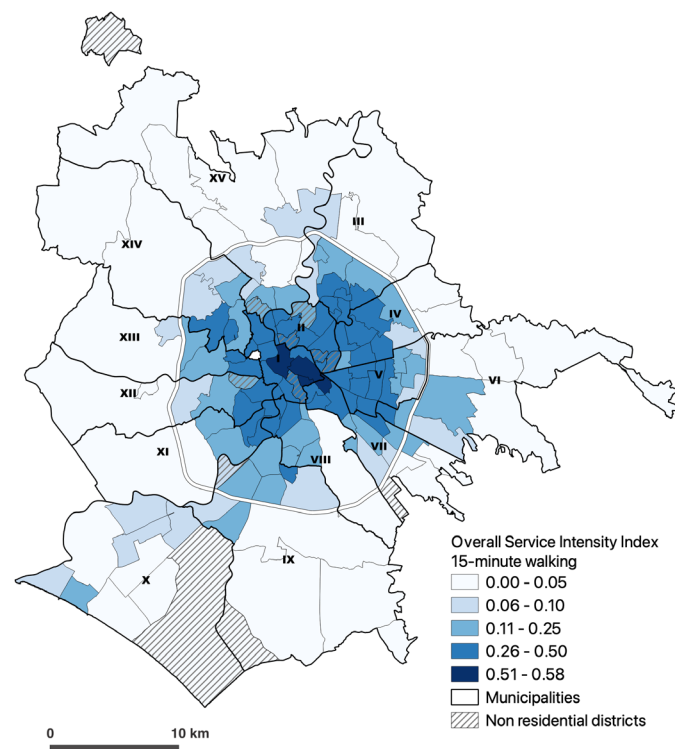


Figure 5. Proximity to urban services in 15 min walking. Source 9. Own elaboration on data in Table 1.

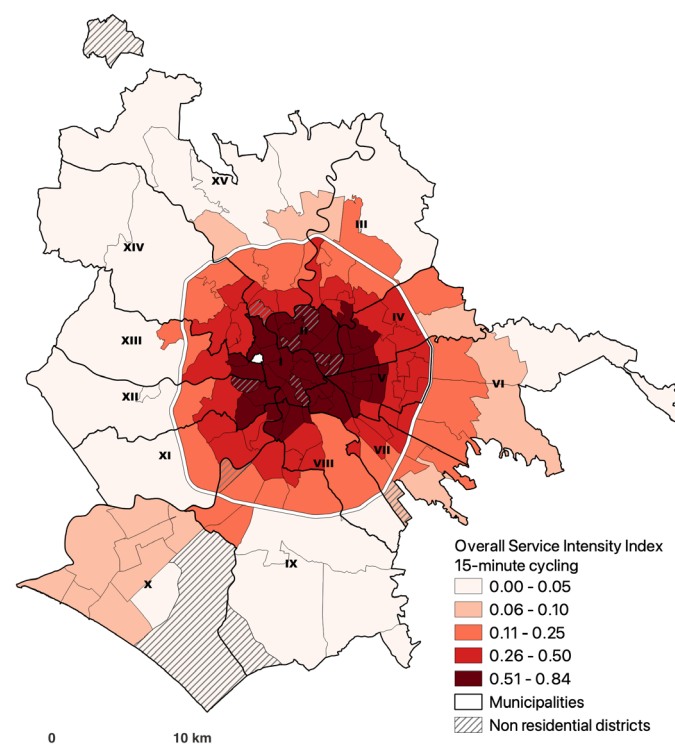


Figure 6. Proximity to urban services in 15 min cycling. Source 10. Own elaboration on data in Table 1.

7. Conclusions

Cities offer great opportunities by virtue of their nature as vast markets and incubators of ideas, and the concentration of public and private investments. But opportunities are

not evenly distributed as cities are not isotropic spaces, and it does not always make sense to measure their performance in aggregated terms. The conditions of marginalisation that affect numerous neighbourhoods in our cities, as well as the socioeconomic inequalities that arise from them, depend on multiple factors of a historical, physical, social, and economic nature.

The 15 min city model is intimately bonded to the concept of spatial inequalities. Its global success has led to “proximity” becoming a buzzword for many city administrations, generating renewed interest in the concept and the related urban practices [83].

In our attempt to analyse the proximity to urban services in Rome from the perspective of the 15 min city, we assess the distribution of Urban Social Functions (USFs) at the sub-municipal level and, further on, we extend our analysis to the “seven cities” of Rome to obtain insights into the services distribution in relation to the socioeconomic characteristics of different urban contexts.

The results clearly indicate the existence of strong imbalances, both in terms of the spatial coverage and in terms of the thoroughness of USFs. The service distribution clearly reflects the monocentric urban structure of Rome. Areas distant from the centre are affected by a severe lack of services, even the basic ones like food [84]. But looking exclusively at the city’s physical characteristics might be misleading. The socioeconomic characterisation of areas is revealed to be at least as influential as the distance from the city centre. This is evident while looking at the service provision disparities between wealthy and poor neighbourhoods located far from the centre. Our analysis provides new evidence of the fact that the disadvantaged areas of the city suffer the most from the lack of proximity to services, which, in turn, negatively affect the most vulnerable social groups, including women, young people, and migrants, as evidenced by the poor performance of many socioeconomic indicators [27,59].

The urban areas with higher levels of both walking and cycling proximity are characterised by an ageing population, robust cultural and public services, and the presence of public spaces and small-scale retail shops. The walkability and diversity of services foster vibrant street life and frequent social interactions, which enable residents to embrace their preferred lifestyles. These areas generally attract wealthier and more educated residents who can afford higher costs of housing, so that they can enjoy public services, cultural amenities, shops and infrastructure.

Conversely, many peripheral areas, especially those beyond the ring road, exhibit much lower levels of both walking and cycling proximity. Despite having, on average, a younger population and larger households, people living in these neighbourhoods have limited access to cultural and educational opportunities, facing the risk of exclusion from both education and the labour market, and often perceive themselves as not only economically disadvantaged but also socially marginalized, politically sidelined, and overlooked by central institutions. In these areas, people mostly rely on their own vehicles rather than walking or cycling, and the scarcity of public spaces causes them to opt for large malls over small-scale retail shops for their shopping needs, further limiting their social exchanges ([63], pp. 41–51; 14–21; 34–39). These complex socio-spatial dynamics have produced rising levels of discontent, enhancing electoral support for right-wing or populist parties in large parts of the city [85].

There is a compelling need to address the problems arising with the distribution of services, the mobility infrastructures, the difficult social and economic conditions to reduce the gaps and ensure a more balanced and equitable distribution of opportunities across the city. Visitors and tourists generally know the central, dense and walkable districts with 15 min proximity to almost all services. But our analysis shows that these districts are not the places most Romans live. Half of the population has insufficient access to urban services. These deficiencies, occurring in large parts of the city, which are progressively becoming populated, deeply affect the quality of life, making the proximity revolution in Rome a true emergency.

In this context, the role of policymakers is not easy. An important task in this process is related to better governance of the city, particularly in terms of decentralizing powers from City Hall to the 15 municipalities into which Rome is administratively divided. The current decentralisation regulation of Rome dates back to 1999, and a revision process is currently underway. The conclusion of this process is particularly significant for achieving polycentrism, which is a central element of the proximity revolution embodied by the 15 min city.

Our work is intended to proceed from here, with the not-so-hidden ambition of being useful to those responsible for defining policies in Rome by bringing this issue to the attention of policymakers.

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Appendix A

Table A1. List of the Urbanistic Zones (ZUs) of Rome, by Municipality.



Table A1. Cont.

Districts	Urban Areas
I	1A Centro Storico, 1B Trastevere, 1C Aventino, 1D Testaccio, 1E Esquilino, 1F XX Settembre, 1G Celio, 1X Zona archeologica, 17A Prati, 17B Della Vittoria, 17C Eroi
II	2A Villaggio Olimpico, 2B Parioli, 2C Flaminio, 2D Salaria, 2E Trieste, 2X Villa Borghese, 2Y Villa Ada, 3A Nomentano, 3B San Lorenzo, 3X Università, 3Y Verano
III	4A Monte Sacro, 4B Val Melaina, 4C Monte Sacro Alto, 4D Fidene, 4E Serpentara, 4F Casal Boccone, 4G Conca d'Oro, 4H Sacco Pastore, 4I Tufello, 4L Aeroporto dell'Urbe, 4M Settebagni, 4N Bufalotta, 4O Tor San Giovanni
IV	5A Casal Bertone, 5B Casal Bruciato, 5C Tiburtino Nord, 5D Tiburtino Sud, 5E San Basilio, 5F Tor Cervara, 5G Pietralata, 5H Casal de' Pazzi, 5I Sant'Alessandro, 5L Settecamini
V	6A Torpignattara, 6B Casilino, 6C Quadraro, 6D Gordiani, 7A Centocelle, 7B Alessandrina, 7C Tor Sapienza, 7D La Rustica, 7E Tor Tre Teste, 7F Casetta Mistica, 7G Centro Direzionale Centocelle, 7H Omo
VI	8B Torre Maura, 8C Giardinetti-Tor Vergata, 8D Acqua Vergine, 8E Lunghezza, 8F Torre Angela, 8G Borghesiana, 8H San Vittorino
VII	8A Torrespaccata, 9A Tuscolano Nord, 9B Tuscolano Sud, 9C Tor Fiscale, 9D Appio, 9E Latino, 10A Don Bosco, 10B Appio-Claudio, 10C Quarto Miglio, 10D Pignatelli, 10E Lucrezia Romana, 10F Osteria del Curato, 10G Romanina, 10H Gregna, 10I Barcaccia, 10L Morena, 10X Ciampino
VIII	11A Ostiense, 11B Valco San Paolo, 11C Garbatella, 11D Navigatori, 11E Tor Marancia, 11F Tre Fontane, 11G Grottaperfetta, 11X Appia Antica Nord, 11Y Appia Antica Sud
IX	12A Eur, 12B Villaggio Giuliano, 12C Torrino, 12D Laurentino, 12E Cecchignola, 12F Mezzocammino, 12G Spinaceto, 12H Vallerano Castel di Leva, 12I Decima, 12L Porta Medaglia, 12M Castel Romano, 12N Santa Palomba, 12X Tor di Valle
X	13A Malafede, 13B Acilia Nord, 13C Acilia Sud, 13D Palocco, 13E Ostia Antica, 13F Ostia Nord, 13G Ostia Sud, 13H Castel Fusano, 13I Infernetto, 13X Castel Porziano
XI	15A Marconi, 15B Portuense, 15C Pian due Torri, 15D Trullo, 15E Magliana, 15F Corviale, 15G Ponte Galeria
XII	16A Colli Portuensi, 16B Buon Pastore, 16C Pisana, 16D Gianicolense, 16E Massimina, 16F Pantano di Grano, 16X Villa Pamphili
XIII	18A Aurelio Sud, 18B Val Cannuta, 18C Fogaccia, 18D Aurelio Nord, 18E Casalotti di Boccea, 18F Boccea
XIV	19A Medaglie d'Oro, 19B Primavalle, 19C Ottavia, 19D Santa Maria della Pietà, 19E Trionfale, 19F Pineto, 19G Castelluccia, 19H Santa Maria di Galeria
XV	20A Tor di Quinto, 20B Acquatraversa, 20C Tomba di Nerone, 20D Farnesina, 20E Grotta Rossa Ovest, 20F Grotta Rossa Est, 20G Giustiniana, 20H La Storta, 20I Santa Cornelia, 20L Prima Porta, 20M Labaro, 20N Cesano, 20O Martignano, 20X Foro Italico

Source 5. Elaboration on Roma Capitale data.

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