Chapter

Walking Accessibility to Primary Healthcare Services: An Inequity Factor for Olders in the Lisbon Metropolitan Area (Portugal)

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Abstract

This chapter discusses the walking accessibility to primary healthcare by the olders in Lisbon Metropolitan Area (LMA), Portugal, and its contribution for age-friendly environments as a factor of inequity. Constrains emerged from the collation of the supply approach, represented by service catchment areas based on walking distance time, and the demand approach, through a survey. The location and density of primary health network are a major factor, as it is related to distinct land use patterns within the LMA. The settlement structure influences the potential walkability to primary healthcare. The discrepancy between the potential walking accessibility and the real options is notorious, as olders` choices are diversified in terms of transportation modes and destinations, but mostly keeping relatively short time distances. This phenomenon is also influenced by factors such as personal preference, difficulty to walk, negative perceptions about the surroundings, and insufficient care support. This debate is already an effective concern of local authorities with spatial planning, social and health competences, insofar as solutions in terms of service flexibility and new travel solutions adapted to the specific needs of the olders are a growing reality in the LMA, promoting more age-friendly, health, and inclusive environments, and hence an equitable metropolis.

Keywords: older people, walking accessibility, primary health services, service catchment area, inequity, healthy cities, age-friendly environment, Lisbon Metropolitan Area

1. Introduction

Population aging is one of the most evident demographic phenomena around the world. The United Nations (UN) estimates that the number of people aged 60 and over will double by 2050 and triple by 2100 (corresponding to 3.1 billion people) [1]. This age group is considered one of the most vulnerable in society, particularly affected by poverty, illness, and social isolation [2], and it is often studied as a

homogeneous group when there are several factors that distinguish older individuals (age, education level, family context, income, physical and mental health conditions, mobility level, technological capacity, etc.) [3].

In this sense, spatial planning and service networks must be adapted in advance according to the long-term demographic projection and based on a deep knowledge of the current reality, being extremely important to confront the needs of the population and the response capacities of the territories and services [4].

This study focuses on the debate about the walking accessibility to primary health services by the older in the Lisbon Metropolitan Area (LMA), in Portugal, for healthy and age-friendly environments since the level of proximity to services and the ability to reach them are fundamental to promote a healthier aging and greater equity in and among communities. The study presents three research questions (RQs):

RQ1) Is the location within the LMA a differentiating element of walking accessibility to primary health services (PHS) and hence an inequity factor?
RQ2) Do the olders demand for PHS consistent with what is expected to have in age-friendly environments?
RQ3) What kind of solutions are implemented in LMA to promote a more equitable access to PHS by the olders?

The study combines several approaches. We seek to identify possible constraints to equity based on the accessibility to health services: (i) the potential of walking accessibility generated by network analysis recurring to geographic information systems and using adapted criteria to the older community; (ii) the actual demand patterns of the olders gathered from an applied survey in LMA; and (iii) the identification of solutions at local, municipal, and metropolitan levels in the LMA and energized by local authorities, health services, nongovernmental organizations, or social institutions to minimize inequity situations.

The chapter is organized into six parts: Section 1 respects to the introduction and is followed by a theoretical rationale centered on walking accessibility to primary healthcare by the older people in Section 2, and the presentation of the methodology and case of study in Section 3. The discussion of the results based on the confrontation between the supply and demand approaches of primary health services by the olders in LMA is presented in Section 4, and some initiatives that minimize the identified constraints in LMA are addressed in Section 5. The chapter ends with the main conclusions (Section 6).

2. Accessibility to healthcare services for age-friendly environments

The rapid aging of the world population is considered one of the major global challenges. On the one hand, it is seen as a positive phenomenon insofar as it represents social, economic, and biomedical progress due to generalized better feeding, personal hygiene, healthcare, and housing conditions, among many other aspects. On the other hand, it reflects a demographic trend that combines increasing life expectancy and falling fertility rates [5]. In the long term, and related to a time of growing urban population, this phenomenon will bring an overload of the social and health systems, among other services and infrastructures, and the need to readjust them [4, 6]. In a larger level, this will affect the regional competitiveness and make the social and territorial cohesion difficult. This is based on the perspective that

the older population will, at some point, become more dependent on society and greater demanders in terms of physical and/or mental healthcare and supportive care [7]. On the other hand, their moving limitations could promote social isolation and a strong feeling of loneliness, considered by the Joint Research Center as a public health issue with negative impacts on community trust, social cohesion, and economic growth [8, 9].

However, it is a mistake if we consider that all people over the age of 65 have the same characteristics and needs, and that remains the same over time. Given the conditions of the modern world, in Europe, as in other World regions, we are witnessing the existence of a group of older people who are more active, qualified, informed, socially participatory, mobile, technological, and demanding in the cultural and recreational domain [10, 11]. To respond to these demands, their living spaces have expanded from the local to the regional/metropolitan level [12]. On the other hand, the increase in average life expectancy is reflected in the existence of individuals with diversified health conditions, namely about disease prevalence and different physical and mental conditions, influenced by the natural aging process, genetics, lifestyle, and the surrounding environment [13].

In the quest to keep the olders as an active part of society, with good health and well-being levels until as late as possible, adaptations in the urban environment of communities and cities must compensate the physical, mental, and social changes associated with aging. Operationally, this is observed in the guidelines promoted by institutions such as the United Nations and the World Health Organization (WHO) and reflected in the naming of this decade as "The United Nations Decade of Healthy Aging (2021-2030)" [14], with a view to improve the lives of older people, their families, and the communities in which they live.

In urban planning, the "Age-friendly Cities and Communities," that is, "(...) places that actively involve, value, and support older adults, both active and frail, with infrastructure and services that effectively accommodate their changing needs," is one of the most widespread urban models ([15], p. 1). Simultaneously, Age-friendly Cities and Communities is an initiative of the WHO, started in 2006, to support active and healthy aging at local level. "Housing," "Social participation," "Outdoor spaces and buildings," "Transportation," and "Community support and health services" are some of the focused topics [4].

In this model, as in others as "sustainable communities," "healthy cities," or the "15-minute city," the principle of proximity is fundamental [16, 17]. Proximity refers to the distance (physical or not) and/or distance time to the different destinations where individuals live: workplace, various services, goods and equipment, public spaces, green spaces, commercial areas, cultural spaces and leisure; but also to the network of contacts: family, friends, or other social networks. The proximity to people and living areas as a way of satisfying individual needs are enhancers of a greater quality of life and well-being, active participation in society, maintenance of the practice of physical and mental activity, and greater autonomy [18]. Despite the studies regarding the concept of proximity (e.g., 15-minute walking, radius distance of 500 meters, etc.), this is conditioned by the ability and perception of individuals, especially when we refer to the older community, where part of it has age natural mobility constraints.

The principle of proximity as a factor of an age-friendly, healthy, inclusive, and sustainable environment leads us to the promotion of a walkable environment, and this is an environment based on active transport modes, namely the walking in and around the community, to enhance, simultaneously, an equitable accessibility

to all destinations and a positive physical activity engagement [19]. This discussion requires a double understanding about (1) the relationship between urban mobility, particularly in the older people context, and the built environment; and (2) the characteristics and specificities of each community [20].

Hence, recent research promotes an holistic perspective that relates the social and physical environments, recurring to digital tools and services, to promote better health, independent living, active participation, and more equity. See, for example, the SHAFE project results [21, 22] that present the community level as the physical, social, and cultural ecosystem closest to the people and their daily lives.

The mobility of all, as the ability to meet the needs to move freely [23], is one of the challenges that cities have for pursuing social and civic life, participation in community activities, the development of a sense of belonging, and to promote health and well-being through the possibility of accessing health services, green spaces, commercial areas, leisure and cultural spaces, etc. [24]. Hence, it is utmost important to consider that the cognitive and motor skills of olders deteriorate over time, affecting their mobility [25]. This is reflected in constraints on walking speed, the ability to freely drive or use public transport, the increase in falls and the feeling of insecurity when walking on the street, and constraints that, at the limit, avoid carrying out their daily lives autonomously [26].

Mobility is also a reflection of a mutual interaction between the built environment and olders` behavior, insofar the organization of the physical and functional components of urban system generates the opportunities for movement in the context of urban life. Thus, the configuration of the urban system must be adapted to the needs of the elderly [27]. This interaction raises the importance of thinking about improving urban accessibility, that is, the ability of an individual to reach a certain place, through a certain transport mode and in a certain time. This requires a relational reading between the conditions of transport infrastructure networks (and the ease of travel in terms of distance and time), the location of activities and services of general interest proximity between services and users), and the characteristics and needs of users [27–29].

As health is a universal right, the planning of public health services must consider three fundamental principles [30], which sometimes collide. The first concerns the "Equity in service provision," represented by the equal access to healthcare for people in equal need. This premise is related to the notions of spatial fairness and spatial justice that considers the geographical context as an influencing factor. The second is the "Effectivity of health services," balancing the real health benefits and the resources management. The last is the "Efficiency of health services" maximizing the health benefits and minimizing the costs of provision.

Focusing on the health services at the local level, Primary Health Care (PHC) is the first contact between the individual and the health system, as it "provide complete care to people, according to their health needs throughout their lives and not only for a set of specific diseases. (...) ensure that people receive comprehensive care, from promotion and prevention to treatment, rehabilitation and palliative care, as close as possible to their daily environment." [31, n.p.]. It is stated that a PHC-based health system allows for greater efficiency of more specialized care (e.g., hospital care), lower hospitalization rates, and reduced individual and government health expenditures [31].

A primary health service with positive impact on health, quality of life, and well-being should present good levels of access [4], considering several demand factors: availability and diversity of health services, frequency of use, individual and family

factors, physical and social environment, among others [32, 33]. Over time, several studies addressed this topic [28, 29, 33–36], combining the approaches of health service providers and users, reflected in the following principles:

i. Availability, as the existence, quantity, and maximum capacity of the services;

ii. Accessibility, associated with the physical proximity between services and users and the ease of travel to them in terms of distance, time, and transportation modes;

iii. Affordability, related to the costs for users;

iv. Adequacy, in terms of service organization and convenience for the user (waiting time, ease of dealing);

v. Acceptability, represented by the trust and satisfaction with the services by the users;

vi. Knowledge, articulating the communication and dissemination of knowledge by users, health professionals, and others.

Accessibility to health services arises the need of a multisectoral and multilevel approach, in this case related, for example, to the healthcare network, mobility and accessibility, and demographic characteristics in each territory as they are influencing factors of healthcare inequalities [36]. Among other methodologies, the levels of physical accessibility of each service could be evaluated recurring to geographic information system (GIS) [17, 23, 32, 33, 36]. Here, it is possible to model the respective service catchment area in a certain distance and/or distance time, based on the various transport modes or their combination. Service catchment areas allow to quantify the total area and served population within the proposed thresholds (e.g., within 15-minute walking in a determined speed); to identify worse served communities, and hence more vulnerable; and to relate it to context indicators in the social, economic, and territorial domains [29, 36, 37]. This analysis is also a potential support element for the restructuring of the service networks through the identification of new service positioning for better population and territorial coverage rates [38], to adapt the transport system in order to promote better accessibility level, or even to support the design of innovative, flexible, and informal solutions promoted by various stakeholders [22].

3. Methodological steps and case study framework

The methodology of this study followed three steps (**Figure 1**), in order to answer the research questions.

Step 1 involved a literature review, not only for thematic framing of the mobility conditions of the older people and their specific constraints (e.g., pedestrian speed), but also for the identification of the main methodologies and accessibility indicators, specifically adapted to the olders.

Step 2 refers to the application of the assessment of walking accessibility to primary healthcare from the perspective of the older people in the case of the Lisbon

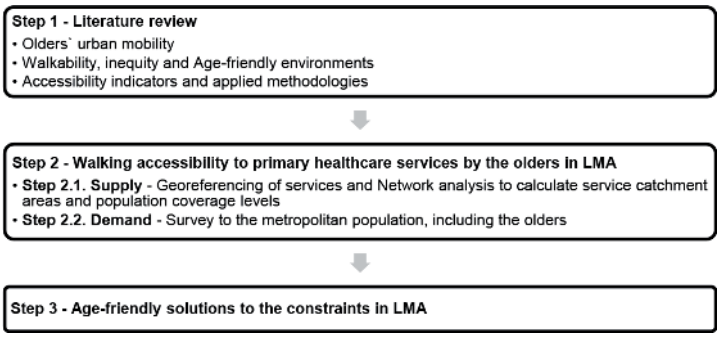

Figure 1.
Methodological steps of the research.

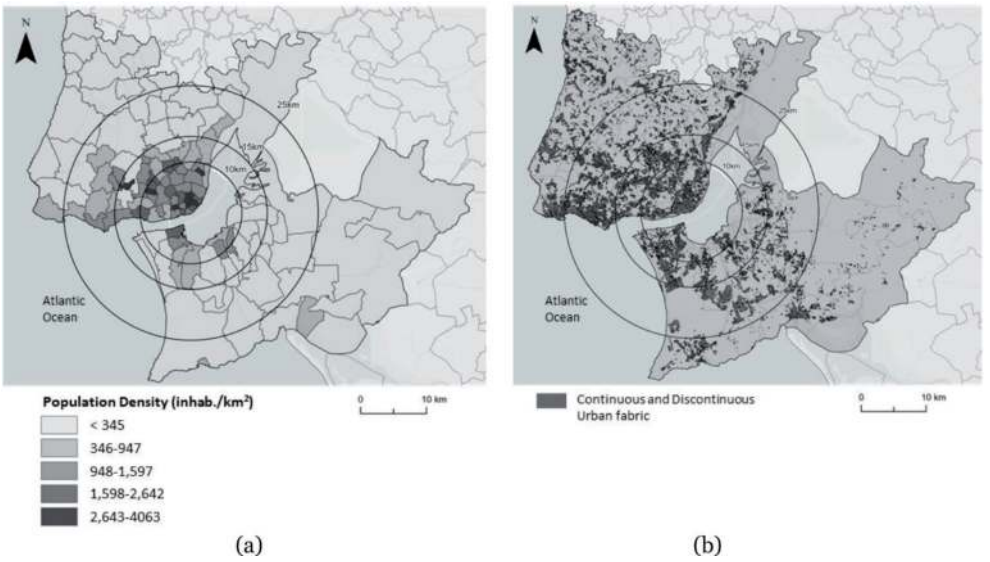

Figure 2.
(a) Population density of older people (65+ years old); (b) land use in LMA—urban fabric. Source: [40, 41].

Metropolitan Area, Portugal. LMA is spread over by 18 municipalities, totaling 3015km^2, and has a total population of 2,870,770 inhabitants, in 2021, and a population density of 952 inhab./km^2. About 22% of LMA's people are aged 65 or over (proportionally to the national figure of 23%) [39], unevenly distributed among the LMA, emerging a radioconcentric pattern, with higher older population densities in the parishes of the central areas (Lisbon & Ring 1 and Ring 2) and decreasing toward the peripheral areas (Ring 3 and Ring 4).

The population distribution is consistent with the urban occupation that presents the same radioconcentric pattern. The central metropolitan areas present a higher proportion of occupation, reflecting their urban/suburban and dense profile, while the peripheral areas present more dispersed urban occupations, reflecting the peri-urban occupation, except some urban continuum axes that grew along major road and rail axes (**Figure 2**).

In Step 2.1., network analyses based on geographic information systems (GIS) allowed to visualize the service catchment areas of primary healthcare facilities and to quantify the served resident population, considering the geographic location of

the equipment, the constraints of the transport network, and the characteristics of pedestrian mobility. The service areas were modeled, and the served population was calculated based on time-distance cutoffs of (i) until 15 minutes; (ii) 16–30 minutes; (iii) 31–60 minutes; and (iv) more than 60 minutes [32, 33, 36]. This approach considers two walking criteria: (a) average speed of the older people of 3.5 km/; and (b) average speed of disabled older people of 1.6 km/h [25, 36]. This step will answer to RQ1.

Step 2.2., related to demand, presents the results of a survey applied to the LMA population in 2017, including the older people. Based on the total sample of 403 families, with respect to 1004 individuals surveyed (for a Significance Level of 95% and a Margin of Error of 5%), we extracted the responses of 131 older adults from 111 families for this study. The total sample took into account the demographic distribution of the metropolitan population (age, sex, and family typology) and its geographic distribution considering the central area of Lisbon and its sequential four rings based on the distance to the Lisbon city (**Figure 3**). Such rings represent territories with urban land use profiles and, consequently, very different population densities, housing and services location, health services, and transport networks. This step will provide the answer to RQ2.

This survey collected information as: (i) the characterization of the respondents (age, income, family background, area of residence); (ii) the demand for primary healthcare services (location, frequency, travel mode, and time spent in the travel); and (iii) individual perceptions about personal health, safety, traffic, noise, and air pollution caused by transport in the residential area (as environmental factors). Hence, it was possible to discuss the results obtained in Steps 2.1. and 2.2., confronting the potential accessibility to primary healthcare services and the actual behavior of the surveyed older people.

Finally, Step 3 addresses some strategies to minimize older's constraints to health accessibility in LMA, giving already implemented examples in three lines of action: (i) strategic plans oriented toward an healthy and inclusive aging; (ii) health services at home or in the proximity; and (iii) promotion of flexible transport to reach health services. This step answers to the RQ3.

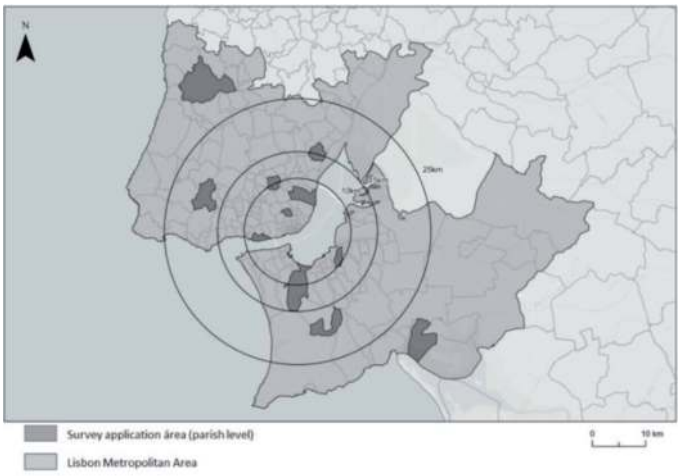

Figure 3.
LMA rings and the 11 parishes where the surveys were applied.

4. Supply and demand of primary healthcare services of LMA's older people

4.1 Supply approach to primary healthcare system in LMA

The last restructuring of the Portuguese health system dates from 2008, when the Constitutional Government recognized primary healthcare as a central pillar of the health system, published in the Decree-Law nº 28/2008, of February 22 [42]. One of the novelties was the creation of "groups of health centers" (ACES, in Portuguese Agrupamento de Centros de Saúde), with the function of providing primary healthcare to the population of a certain geographic area. Such geographic delimitation is related to geodemographic criteria (e.g., population structure, aging index, accessibility to the referral hospital), and with a population range between 50,000 and 200,000 residents.

The ACES have several functional units [42], namely:

a. Family Health Unit (USF—Unidade de Saúde Familiar), a unit providing healthcare to the group of users enrolled therein, with functional and technical autonomy;

b. Personalized Health Care Unit (UCSP—Unidade de Cuidados de Saúde Personalizados), a unit that provides personalized care in a given geographic area;

c. Community Care Unit (UCC—Unidade de Cuidados na Comunidade), providing healthcare, psychological and social support at home, especially to vulnerable individuals/families, in situations of risk or dependence, and in the area of health education and implementation of mobile intervention units;

d. Public Health Unit (USP—Unidade de Saúde Pública), a health observatory in the geographic area of ACES, for the elaboration of plans in the domain of public health, surveillance, management of intervention programs, and health promotion.

In January 2022, the network of Family Health Units (USF) and Personalized Health Care Units (UCSP), the most relevant functional units in the provision of healthcare, was widespread and complementarily distributed in the LMA, totalizing 225 units (153 USF and 72 UCSP) (**Figure 4**). Only 1.5% of the LMA surface and 0.5% of the population are not allocated to any of the USF/UCSP facilities.

Given their valences and functions, the studied health services have a limited schedule, but consistent with the law. The vast majority of services start at 8:00 am (94%), and the rest at 9:00 am, while the closing time is more diverse, between 4:00 pm and 8:00 pm, with a higher incidence at 8:00 pm (63%) and at 6:00 pm (22%).

Considering the proximity logic of primary healthcare services, it is desirable that the entire population has access to the equipment in which they are enrolled in a relatively short distance time, not forgetting that this indicator depends not only on the locations of the residence and equipment, but also by the selected transport mode. In the case of older people, it is important to approach car use based on the legal allowed speeds, but also the license possession and driving skills (factors influenced by the

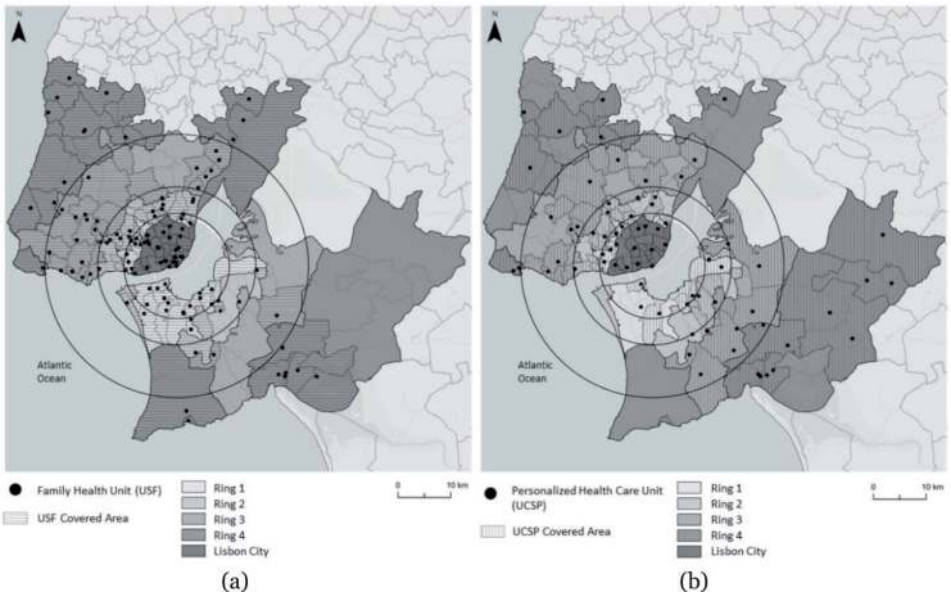

Figure 4.
Location of USF and UCSP equipment by LMA ring, 2022: (a) family health units; (b) personalized health care units. Source: Based on [43].

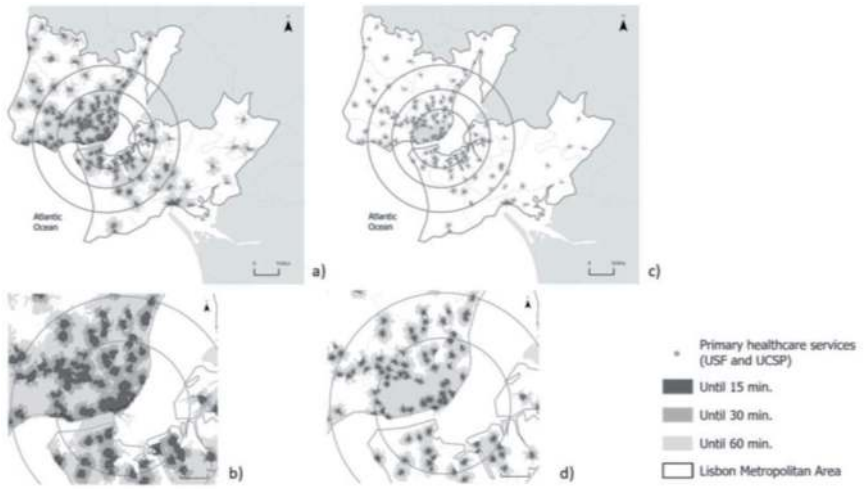

Figure 5.
Service catchment area of primary healthcare services (USF and UCSP) according to different time-distance cutoffs in all LMA (a) and (b) and zoomed in to the LMA Center (b) and (d); and different walking speeds: 3.5 km/h (a) and (b), and 1.6 km/h (c) and (d).

individual conditions of the users) [24]. Regarding walking mode is fundamental to consider the diversity of realities within the age group over 65 years old in terms of individual mobility ability, as this influences the walking speed (e.g., 3.5 km/h of regular pedestrian speed of an older person, 1.6 km/h on conditioned pedestrian speed cases) [32, 36].

Figure 5 demonstrates the accessibility level to healthcare services in the LMA, based on the representation of the service catchment areas of all equipment (USF and UCSP) by pedestrian mode conditioned to the aforementioned speeds, while

	Walking speed of 3.5 km/h—Inhabitants with 65 or more years old					
	Until 15 min.		Until 30 min.		Until 60 min.	
	Inhab. (%)	Surface (%)	Inhab. (%)	Surface (%)	Inhab. (%)	Surface (%)
Lisbon & Ring 1	68.5	31.2	98.4	77.4	100.0	88.8
Ring 2	53.8	11.7	81.8	32.3	97.6	72.5
Ring 3	43.1	4.9	76.8	16.2	93.0	43.4
Ring 4	43.9	2.2	69.2	6.8	86.6	22.4
Total	56.8	5.8	86.2	16.3	96.3	37.6
	Walking speed of 1.6 km/h—Inhabitants with 65 or more years old					
	Until 15 min.		Until 30 min.		Until 60 min.	
	Inhab. (%)	Surface (%)	Inhab. (%)	Surface (%)	Inhab. (%)	Surface (%)
Lisbon & Ring 1	33.0	9.7	63.8	27.6	96.9	72.8
Ring 2	22.7	3.3	49.2	10.3	79.0	28.6
Ring 3	17.8	1.3	38.6	4.2	73.1	14.0
Ring 4	23.0	0.6	41.7	1.9	65.5	5.8
Total	26.2	1.7	52.5	5.0	83.7	14.5

Table 1.
Inhabitants with 65 or more years old (%) and surface (%) covered by service catchment areas of primary healthcare services (USF and UCSP) according to different time–distance cutoffs (until 15 min., 30 min., and 60 min.) by LMA ring (absolute values available on **Appendix 1***). Source: own calculations based on BGRI [40] and service catchment areas calculated on network analysis function of ArcGis.*

the proportion of the surface and population covered by these service areas by ring is quantified in **Table 1**; and **Appendix 1**. In a scenario where the entire population of LMA travels in a walking speed of 4.5 km/h, then 65% of the population would reside within 15 minutes nearby health service. This proportion reduces to 57% if we consider only the olderly population, assuming a walking speed of 3.5 km/h, drastically reducing to 26% if we assume a walking speed of 1.6 km/h. A detailed analysis highlights three evidences (**Table 1**).

Firstly, the distribution of primary healthcare services (USF and UCSP) is in line with the urban system of the LMA, insofar as they are essentially located in the most densely populated areas [41]. This evidence comes from the higher percentage of population served at any time–distance limit in any ring compared with the percentage of covered area. For example, the served population at a distance time of 15 minutes at a walking speed of 3.5 km/h attends 69% in Lisbon & Ring 1 for only 31% of the covered territory. Keeping the criteria, in Ring 3 this situation is even more evident: 43% of the population served for only 5% of the ring surface. In LMA case, in the more peripheral Ring 3 and Ring 4 there are large unpopulated areas or with a very low population density, with land allocated to agricultural or forestry uses, for example.

This high complementarity between the urban system and the primary healthcare service system in the LMA could not happen in other metropolitan areas, highlighting the priority to study the served population by levels of distance time. Thus, the approach for urban planning should seek to increase the proportion of

served population and respective conditions, rather than only focus to increase the served territory [33, 36].

Secondly, in the context of the LMA, is clear a ring differentiation in terms of walking accessibility to primary healthcare services. The central rings, closer to Lisbon, have better accessibility levels, which means that a greater proportion of older people lives close to the services. For example, 69% of the olders in Lisbon & Ring 1 and 54% in Ring 2 live within a 15-minute walking distance from the equipment (speed of 3.5 km/h), compared with 43% in Ring 3 and 44% in Ring 4. The same pattern is found in the constrained walking speed simulation (1.6 km/h): 33% in Lisbon and Ring 1, compared with 18% in Ring 3 and 23% in Ring 4.

This pattern is related to the socio-urban characteristics of each ring. In Lisbon and in the two following rings, there is a combination between a more concentrated urban occupation and a greater population density, thus generating a more numerous and spatially closer health facilities network, serving a larger number of residents in a short dispersed area. Thus, the proportion of residents and area served within 15-minute walking are higher than in the more peripheral areas (rings 3 and 4). These last rings present a more dispersed and mostly peri-urban occupation profile, although there is existence of some relevant urban areas especially nearby the major road and rail axes. In these areas, population is distributed between small urban concentrations where the main services are located and very low dense areas further away from small urban centers [28, 40, 41]. This increase the official service area allocated to each equipment to maintain criteria of resources` efficiency and the number of users according to the law [42].

Lastly, the differences in walking speeds are highly penalizing the relationship of proximity between health facilities and users, in particular for users who have mobility constraints such as the older people [19, 24]. We can observe this situation by comparing the served LMA's older people up to 15-minute walking from a primary healthcare service: 57% when the walking speed is 3.5 km/h and 26% when the walking speed is 1.6 km/h.

Answering to RQ1, the results obtained raise a clear situation of inequity in the walking accessibility to the primary health services, penalizing the communities located in the most peripheral rings of the LMA, and particularly the age group of the olders, considering their pedestrian speed limitation (according to with the bibliography). This situation of inequity is further reinforced when the response of the public transport system in peripheral (and hence, more vulnerable) communities is also more limited in terms of network and service (fewer routes and less frequent service), when compared with the central areas of the LMA [12, 28].

This reading also highlights two aspects. Firstly, the importance of an analysis of accessibility indicators to health services considering the urban context [44], the settlement distribution, and the transport network, since a global analysis at the regional or metropolitan scale creates generalized ideas, insufficiently adequate to support the health service network planning in complementarity to the urban and transport systems, especially at the local level. This approach allows the discussion about inequity in a determined territory. Secondly, the need to compare the quantification of accessibility levels previously calculated using geographical modeling and the actual behavior of individuals, in this case those over 65 years of age, to validate whether better or worse walking accessibility to health services reflect real pedestrian displacements by these communities. Large discrepancies between potential and real walking accessibility must be studied in order to identify influencing factors (Section 4.2), as well as to support the design of flexible and/or informal solutions to minimize accessibility and access difficulties to health services (Section 5).

4.2 The demand for primary healthcare services in the perspective of older people in LMA

In addition to the analysis of primary healthcare service supply and its potential walking accessibility, we analyzed the real demand in the LMA through a survey applied to the metropolitan residents in 2017. The results give the real mobility patterns of residents to various activities, namely health services (in a pre-pandemic period). The search questioned the following: (i) the place where people seek such service (in the parish of residence, in the municipality of residence or in another municipality); (ii) the travel time to the destination; and (iii) the preferred transport mode(s).

The sample attends 111 families with older people that corresponds to 131 individuals over 65 years old. Single-person families (43%) are the most representative type of family, followed by couples of aged (26%), and other family types (18%), namely the coexistence of three generations or grandparents living with grandchildren. Around 63% of these aged families have an average monthly income of up to 1000 euro, 21% between 1000 and 1500 euro, and 17% of more than 1500 euro per month. About half of the older respondents affirmed to spend less than 30 euros a month on transport (48%), followed by families with costs between 30 and 60 euros (30%) and 60–150 euros (17%). It is also worth noting that half of the families with older people do not own any vehicle, 34% have one vehicle, and 15% have two vehicles (although the possession of vehicles in the family does not necessarily mean that the older individuals are their users as drivers, but could promote their use as passengers) [24].

Considering only individuals aged 65 or over (**Table 2**), it was observed that the demand for primary healthcare service is mainly based on short-term trips up to 15 minutes (60%), with a still relevant proportion of individuals who take 16–30 minutes (25%). The short duration of each trip also reflects the proximity to the desired destination, mostly in the residence parish (50%) or in another parish in the residence municipality (20%). A fifth of individuals travel to other municipalities, a phenomenon related to the proximity of health services to other moments of daily life (e.g., proximity to the workplace, family housing) or personal motivations and taste (e.g., preference for private services or for a specific doctor). Lastly, the use of individual motorized transport stands out (43%), followed by active modes (walking or cycling) (21%) and public transport (17%). In the LMA, carrying out short-term trips supported by the use of the car is observed not only to reach health services, but also to other goods and services and to school/employment, not only by the olders but also by all communities [23, 28].

Various realities relate the used transport mode to distance-time traveled emerged (**Table 3**). More than 4/5 of who use soft modes make short-term trips (up to 15 minutes) (87%). On the other hand, individual transport is the choice for short-term (74%) and medium-term trips duration (20%), that is, between 16 and 30 minutes. It should be underlined that the higher speed of this mode allows traveling a greater physical distance in the same period. In turn, those who use public transport are essentially to carry out medium-term trips (68%), while those who use various modes of transport are not strongly correlated with one specific time range, except the emphasis on trips of longer duration (more than 31 min.) (15%), compared with the other modes. These results are consistent with the general evolution of urban mobility from the community to metropolis level, increasing the diversity of living areas of individuals in their daily lives and the distance between the area of residence and such destinations, and hence arising new challenges related to the services and transportation planning [12]. An in-depth study differentiating the age of older people could be necessary to differentiate their needs.

	Time-distance – Surveyed inhabitants with 65 or more years old				
	Until 15 min. (%)	**16 to 30 min. (%)**	**More than 31 min. (%)**	**Total (%)**	
Lisbon & Ring 1	68.9	28.9	0.0	100	
Ring 2	54.5	27.3	9.1	100	
Ring 3	43.8	21.9	15.6	100	
Ring 4	75.0	16.7	0.0	100	
Total	59.5	25.2	6.3	100	
	Location—Surveyed inhabitants with 65 or more years old				
	Residence parish (%)	**Residence municipality (%)**	**Other municipalities (%)**	**Total (%)**	
Lisbon & Ring 1	60.0	31.1	8.9	100	
Ring 2	40.9	0.0	31.8	100	
Ring 3	28.1	21.9	37.5	100	
Ring 4	83.3	8.3	8.3	100	
Total	49.5	19.8	21.6	100	
	Transport mode—Surveyed inhabitants with 65 or more years old				
	Soft modes (%)	**Individual transport (%)**	**Public transport (%)**	**Various modes (%)**	**Total (%)**
Lisbon & Ring 1	15.6	46.7	26.7	8.9	100
Ring 2	18.2	36.4	22.7	13.6	100
Ring 3	31.3	34.4	6.3	15.6	100
Ring 4	16.7	66.7	0.0	16.7	100
Total	20.7	43.2	17.1	12.6	100

Table 2.
Accessibility patterns to primary healthcare services (USF and UCSP) by older people by LMA ring.

Different dynamics are observed in the demand for primary healthcare service by LMA's ring, with a greater similarity between Lisbon & Ring 1 and Ring 4 compared with what is observed in Ring 2 and Ring 3 (**Figure 6**). In Lisbon & Ring 1 and Ring 4, there is a predominance of short-term trips/up to 15 minutes and a geographical proximity between the individuals and the destination (mainly in the parish of residence), and in the case of Lisbon & Ring 1 to the residence municipality. It is evident that geographical proximity is not particularly conducive to travel by soft/active modes, since it predominates the car use and public transport in the central area. This situation may result from several factors, namely the physical condition of the older person, the conditions of family support or related with perceptions about themselves and about the surrounding environment [4, 7, 15]. As a note, within this older people's sample, 32% feel healthy, while 38% do not feel healthy (at different levels, but not discussed in depth in this work). About 48% of the older individuals do not feel safe to walk or cycle in the residence area (against 25% who assume the opposite), 41% consider that there is a lot of traffic, and 53% consider that there are high levels of noise and air pollution in the residence area.

	Until 15 min. (%)	16 to 30 min. (%)	More than 31 min. (%)	Total (%)
Soft modes	87.0	13.0	0.0	100
Individual transport	73.9	19.6	6.5	100
Public transport	21.1	68.4	10.5	100
Various modes	61.5	23.1	15.4	100
Total	65.4	27.7	6.9	100

Table 3.
Time spent vs. transport mode to primary healthcare services by older people in LMA.

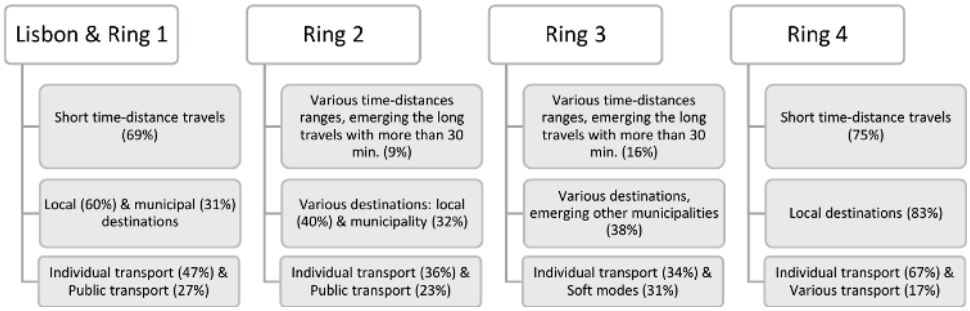

Figure 6.
Synthesis of accessibility patterns to primary healthcare services by older people by LMA ring.

In turn, a greater diversity in the travel tie can be found in Ring 2 and Ring 3, with considerable proportion of respondents who spend more than 30 minutes looking for primary healthcare services. This situation is associated with the destinations of the trip, given the diversity of relevant destinations (parish, municipality, and other municipalities). Private transport maintains its predominance, complemented by the use of public transport in Ring 2 and by soft modes in Ring 3.

In this way, focusing on the RQ2, the expectation for an age-friendly environment related to walking accessibility to primary health services [4, 15, 18–22, 26] is not fully observed in the behavior of the surveyed population, that is, not everyone seeks to access the services under study on foot and in a short time. This situation is due to the combination of several factors, namely the organization of the health system itself (as some equipment is shared between communities and/or municipalities); to personal motivations and perceptions (e.g., insecurity feelings in public space); the physical and mental conditions and level of autonomy of individuals; or the use of complementary services provided by private or other entities (e.g., social institutions or local authorities). The differences between rings arise the importance to relate the results with context indicators of the urban environment in order to identify the main influencing factors of the emerged results [29].

5. Promoting equity minimizing older's constraints to health accessibility in LMA

As it is not efficient to multiply the number of health services and associated physical and human resources in order to increase proximity to all users, it is essential

to create complementary responses, prioritizing the most vulnerable users, and attracting several community stakeholders to the action [21, 22, 23, 45]. This will minimize risk situations caused by the retraction in the demand for health services and promote a better health for all.

The constraints to health accessibility by the olders are not a recent concern in the policy orientations of WHO for Age-friendly Cities [4]. Considering the proposed checklist for cities in the report "Global Age-friendly Cities: A Guide," some premises in the domains of health services and transportation should be implemented. SHAFE project synthetized similar orientations, highlighting as well the main policy documents and possible stakeholders at several levels, to promote smart healthy age-friendly environments [21, 22].

Based on **Table 4**, it is highlighted the need of a health system with a varied offer of services, well distributed territorially and that answers to the community's needs in the domain of health services. Complementarily, the existence of community support services is proposed, namely home services, which alleviates the strain on the service network and promotes better levels of health and well-being for the beneficiaries. On the other hand, and to promote a high quality transportation and a better accessibility level to health services, it is proposed the existence of a good public transport system in terms of affordability, frequency, quality, and comfort of vehicles, territorially spread and that responds to the major origin-destination needs. Quality of transport stops and stations is referred as well as they could be the first barrier to use public transports. As well, community transports are highly pointed to be complementary to the regular public transport system.

In the Portuguese case, municipalities and local organizations that have more proximity to the needs of each community have limited intervention to define policies and get funding to the healthcare model. While the local government involvement in the health domain is residual, other entities as social institutions and nongovernmental organizations present a high degree of organization and power, complementing the public health service [22]. This proves that external stakeholders to the Ministry of Health with health, social and transportation competences (e.g., local authorities, nongovernmental organizations, private institutions of social solidarity, transport operators) are more and more aware of their complementary role in supporting the proximity health service network and especially the older people as a vulnerable group with specific needs [21–23, 45]. In this sense, the provision of community support services has proved to be an asset as a way of bringing services that promote health and well-being closer to them.

In the Portuguese case, some actions are already in operation, namely tele-consultation, transport adapted to citizens, home deliveries of pharmaceutical or food products, home support, or even the adaptation of housing infrastructure (first factor of accessibility limitation) [22]. Specifically to LMA, some examples of recent strategies and/or actions that already exist in the municipalities of the LMA considered as good practices that complement the primary healthcare service formal structure should be highlighted.

5.1 Strategic plans oriented toward an healthy and inclusive aging

Assuming that aging is everyone's business and that the community is the central place for aging policies, this issue begins to be evident in the design of strategic plans and measures that promote a more active, healthy, and sustainable aging process. Measures

Domain age-friendly community and health services
Service accessibility
• Planned distribution of health services and community services in the community/city in complementarity with the transport network;
Offer of services
• Existence of an adequate diversity of services to the community and health services to promote health and minimize the disease;
• Availability of home support services in the area of health and personal care suited to the needs of the community;
Domain age-friendly transportation
Affordability to all older people
• Public transportation affordable to all older people, independently of their income level;
Reliability and frequency
• Public transport reliable and frequent, including at night and at weekends periods;
Travel destinations
• Existence of public transport routes to access to main destinations (e.g., health facilities, green spaces, commercial areas, etc.) within and between communities/cities;
Age-friendly vehicles / Priority seating
• Infrastructural adaptation of vehicles suited to the physical capabilities of the older people (e.g., accesses, seats, priority spaces);
Transport stops and stations
• Location of stops and stations suitable for the settlement system, especially considering the older people, with good safety, cleanliness, and easy access conditions;
Community transport
• Existence of community transport services as a complement to public transport services, resorting to voluntary work and adapted vehicles.

Table 4.
Checklist for Age-friendly Cities in the domains of Community Services, Health Services, and Transportation. Source: own elaboration based on [4].

that promote better and easier accessibility of the older people to health services, applying not only the adaptation of infrastructures, but partnerships with local transport operators or the creation of innovative and informal responses are already a reality.

One of the examples is the Strategic Plan for Sustainable Aging 2016–2025 (PEES) of the municipal council of Amadora, which promotes a set of measures in favor of access and accessibility to health by the older [46]. As part of strategic objective 1 – Promoting safety and physical, psychological, social, and economic integrity of the older people, measures such as "Ensuring increased accessibility to health care for people aged 65+ classified with functional limitation/disability" or "Ensure increased accessibility to healthcare for people aged 65+ enrolled in ACES" stand out. In strategic objective 4 – Promoting mobility, transport and accessibility with better personal comfort and safety condition, we underlined measures such as: "Identify by 2023 public services without accessibility for people with reduced mobility"; "Put into operation in 6 parishes a door-to-door transport service for citizens with reduced mobility to travel to public services, health centers and hospitals"; and "Raise public transport operators' awareness of the need to create or improve internal circuits in the county by 2025".

5.2 Home-based healthcare or in the proximities

There are several solutions that have brought health services closer to their users. For example, several health services are carried out through the displacement of health teams or in which the need for physical displacement is replaced by telehealth services using several technologies (internet, telephone). Delegation of health services competences to other health service providers or partners in the health network (e.g., vaccination in pharmacies; medical care in municipal facilities or institutions of social support; home medication delivery) is already a reality in Portugal. Lastly, local autarchies or institutions of social support also provide health services.

In the period of the Covid-19 pandemic, since 2020, the Lisbon municipal council, in partnership with the Ministry of Health, has promoted an annual flu vaccination strategy benefiting around 165,000 olderly people [47]. This initiative is carried out recurring to mobile health units that travel to the neighborhoods (and, in case of need, to home), and counts on with the collaboration of other municipal entities, such as the parish councils and the fire brigades. The objective is to promote vaccination as a proximity service, preventing people from having to travel to health centers or other health facilities.

Articulated with ACES Oeiras and Lisboa Ocidental, since 2018, the municipal council of Oeiras makes available a home medical service—"Doctor at Home" for people over 65 years old who are beneficiaries of the Special Scheme for Participation in Medicines, identified according to the average income of households (currently meets the need of 2316 citizens) [48]. This service includes a specialized assistance service for triage, medical assistance available 24 hours a day by telephone, and medical consultations at home.

5.3 Promotion of flexible transport to reach health services

It is not only health services that are becoming increasingly flexible, but also transport responses have seen adapted to needs, especially to serve the most vulnerable populations and/or territories. In this way, the different levels of accessibility to health services are no longer such an evident exclusion criterion for the vulnerable fringes of the population. Improvements on the transport system responding to the older's needs in terms of origin-destination, service schedules, adaptation of transport conditions (e.g., lowered entrances, space for wheelchair) are more and more considered, as the existence of flexible transport solutions (door-to-door transport, transport on demand), provided by local authorities, social entities, and transport operators.

In several LMA municipalities, stands out the "Solidarity Transport for the Olderly" initiative as a way to overcome the difficulties that the older people face in transport, minimizing situations of isolation, loneliness, and insecurity [49]. One of the areas where the project is being carried out is in the parish of Carnide, municipality of Lisbon, where the Parish Council has allied with the Association of Retired, Pensioners and Olders of Carnide to create a service for residents over 55 years of age. The destinations are not exclusive to health facilities, but also include commercial areas, green spaces, or any other destination (free of charge within the parish, scheduled by telephone).

In the municipality of Almada exists the inclusive mobility service "Almada BUS Saúde". Operating since 2017, it has reached 500,000 users in early 2020, demonstrating its great utility [50]. With a circular route and without fixed stops, it aims to travel around the main health facilities in the city of Almada (hospital and health centers)

and other public services. Beyond that, the vehicles are specially adapted to transport olderly people and people with reduced mobility.

Lastly, we highlight an equity measure implemented since April 2022 by the TML – Transportes Metropolitanos de Lisboa (Lisbon Metropolitan Transports), as the metropolitan transport authority. The TML decided to create a monthly metropolitan public transport pass with equal cost for all individuals (40 euros), independently of their origin destinations or the transportation modes, with particular adding benefits for specific groups as olders and students, giving a discount of 50% of the monthly cost to these groups [51].

Responding to RQ3, with this small set of examples (among many others already systematized), it is possible to observe the existence of a great diversity of solutions that promote equity in access to PHS in the LMA. The vast majority of the solutions observed are dynamized at the local/community level by different stakeholders. The solutions identified are at the level of policy instruments that frame the studied challenge, but also in the areas of health services and transport. This verification is in line with the theory principles promoting an age-friendly, healthy, inclusive, and sustainable environment considering multisectoral and multilevel approaches and calling on the various community stakeholders to actively participate in the solutions for more equitable communities and metropolises.

6. Final conclusions

This chapter discussed the walking accessibility to primary healthcare by the olders in Lisbon Metropolitan Area (LMA), Portugal, and its contribution for age-friendly environments as a factor of inequity, based on three research questions to which an answer is now given.

Since the health and transport networks are directly related to the LMA's radio-concentric urbanization pattern, metropolitan rings also differentiate the levels of walking accessibility to primary health services. The management of services is essentially anchored in the criterion of the population served by equipment (as a way of maintaining its efficiency in terms of human and financial resources). Thus, denser areas register a network of health facilities with a greater number of equipment and proximity to each other (improving the walking accessibility level), while less dense areas and more dispersed occupation generate greater service catchment area, and hence greater distance between the user and the equipment by part of the population, affecting distance and distance–time measures. Hence, this relation between the health, settlement, and transport networks generates differentiated accessibility levels to healthcare, creating a situation of inequity within the metropolis.

As expected for age-friendly territories, generally, the demand for primary health services takes place through short-term travel. However, such distance time is partially solved through individual motorized modes, in contrast to the proposed modes (walking and public transport). This phenomenon may result from the combination of several factors that require in-depth study (inexistence of public transport? fear of walking? the service is too far? resorting to the family for travel?). Here, there were also different behaviors between the metropolitan rings, highlighting the influence of the characteristics of the health and transport networks in the individuals choices.

Finally, consistently with the guidelines of UN and WHO for age-friendly environments, it is possible to see in LMA the existence of some strategies, from local

to metropolitan level, which complement the limitations of primary health services access by older. Such guidelines are evident (i) in strategic plans (in a top-down orientation); (ii) in the provision of health services at home or in areas closer to users promoted by local authorities, social partners, or other health service providers; and (iii) in flexible, affordable, and adapted transport strategies (both in a bottom-up orientation). These types of initiatives are minimizing inequity situations within and among the LMA's communities.

The usefulness of this work is centered on three aspects: (1) effectiveness of the relationship between the theory relating to the construction of age-friendly environments and a methodology for evaluating situations of inequity in the metropolitan context centered on the principle of accessibility to primary health services; (2) possibility of methodological replication over time for this case study and/or for other territories and services; and (3) production of knowledge to support policy decision in the area of urban planning, and in particular in the fields of health and transportation, with utility at local, municipal, and metropolitan/regional levels, promoting a multisectoral and multilevel approaches. However, some limitations should be acknowledge, as the results are very dependent on the quality and timeliness of the data. For example, in this case, demographic data on the statistical subsection (the Portuguese smallest territorial unit possible) date from 2011, due to the unavailability of data from the 2021 Census until now. This generates possible discrepancies between what was elaborated and the reality, especially in areas of intense new urbanization or areas that are facing population losses. The same applies to the high variability of the organization of health services, with constant restructuring in terms of the equipment physical location and provided services, which can also generate outdated readings. Finally, in order to bring the analysis even closer to reality, the service areas in terms of served parishes of each equipment defined by law should be taken into account, implying an equipment-to-equipment methodological replication.

Hence, the multisectoral reading relating health services and transportation; the combination between the potential accessibility levels to primary health services based on modeling (representing the network supply) and the real behaviors of the older people (as the demand); and the identification of complementary solutions allow us to discuss the accessibility level to primary health services in a more complemented approach. This will better support the urban planning strategies and instruments toward more age-friendly, healthy, and inclusive environments; to a more competitive, social and territorial cohesive territories, and lastly, to more equitable communities and metropolitan areas.

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A. Appendix 1

	Walking speed of 3.5 km/h – Inhabitants with 65 or more years old							
	Until 15 min.		Until 30 min.		Until 60 min.		Total	
	Inhab. (N°)	Surface (Km^2)	Inhab. (N°)	Surface (Km^2)	Inhab. (N°)	Surface (Km^2)	Inhab. (N°)	Surface (Km^2)
Lisbon & Ring 1	147,936	54.69	212,279	135.6	215,703	155.54	215,810	175.11
Ring 2	74,885	44.78	113,889	123.08	135,835	276.44	139,209	381.13
Ring 3	37,734	34.74	67,197	114.23	81,395	306.42	87,496	705.61
Ring 4	31,277	38.59	49,328	117.79	61,781	389.13	71,327	1740.05
Total	291,832	172.8	442,693	490.7	494,714	1127.53	513,842	3001.9
	Walking speed of 1.6 km/h—Inhabitants with 65 or more years old							
	Until 15 min.		Until 30 min.		Until 60 min.		Total	
	Inhab. (N°)	Surface (Km2)	Inhab. (N°)	Surface (Km2)	Inhab. (N°)	Surface (Km2)	Inhab. (N°)	Surface (Km2)
Lisbon & Ring 1	71,175	17	137,594	48.34	209,152	127.51	215,810	175.11
Ring 2	31,646	12.55	68,550	39.09	109,970	108.91	139,209	381.13
Ring 3	15,583	9.37	33,761	29.5	63,996	98.47	87,496	705.61
Ring 4	16,386	11.1	29,760	33.34	46,717	101.54	71,327	1740.05
Total	134,790	50.02	269,665	150.27	429,835	436.43	513,842	3001.9

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References

[1] Envelhecimento [Internet]. 2022. Available from: https://unric.org/pt/envelhecimento/ [Accessed: May 25, 2022]

[2] 4 ways to improve the lives of older people – World Economic Forum [Internet]. 2021. Available from: https://www.weforum.org/agenda/2021/10/healthy-ageing-older-people/. [Accessed: May 19, 2022]

[3] Fitzgerald KG, Caro FG. An overview of age-friendly cities and communities around the world. Journal of Aging & Social Policy. 2014;**26**:1-18. DOI: 10.1080/08959420.2014.860786

[4] World Health Organization. Global Age-Friendly Cities: A Guide. Geneva: WHO; 2007. p. 82

[5] Villaverde Cabral M, Moura Ferreira P, Alcântara da Silva P, Jerónimo P, Marques T. Processos de envelhecimento em Portugal. Lisboa: Fundação Francisco Manuel dos Santos; 2013. p. 381

[6] Louro A, Franco P, Marques da Costa E. Determinants of physical activity practices in metropolitan context: The case of Lisbon metropolitan area, Portugal. Sustainability. 2021;**13**:10104. DOI: 10.3390/su131810104

[7] Coelho C. Envelhecimento e saúde em Portugal: práticas e desafios num cenário de aumento da população idosa (1974-2031). Lisboa: Universidade Nova de Lisboa; 2016

[8] Casabianca E, Kovacic M. Loneliness among Older Adults – A European Perspective. Ispra: JRC; 2022. p. 9

[9] van den Berg P, Kemperman A, de Kleijn B, Borgers A. Ageing and loneliness: The role of mobility and the built environment. Travel Behaviour and Society. 2016;**5**:48-55. DOI: 10.1016/j.tbs.2015.03.001

[10] Aroogh MD, Shahboulaghi FM. Social participation of older adults: A concept analysis. International Journal of Community Based Nursing and Midwifery. 2020;**8**:55-72. DOI: 10.30476/IJCBNM.2019.82222.1055

[11] Wen C, Albert C, Von Haaren C. The elderly in green spaces: Exploring requirements and preferences concerning nature-based recreation. Sustainable Cities and Society. 2018;**38**:582-593. DOI: 10.30476/ijcbnm.2019.82222.1055

[12] Louro A, Marques da Costa N, Marques da Costa E. From Livable communities to Livable Metropolis: Challenges for urban mobility in Lisbon metropolitan area (Portugal). International Journal of Environmental Research and Public Healh. 2021;**18**:3525. DOI: 10.3390/ijerph18073525

[13] Oliveira M. Diversidade: um olhar sobre o idoso. In: Proceedings of the II Congresso de Ensino, Pesquisa e Extensão da UEG. Pirenópolis; 2015

[14] Ageing – United Nations [Internet]. 1999. Available from: https://www.un.org/en/UN-system/ageing [Accessed: May 19, 2022]

[15] Alley D, Liebig P, Pynoos J, Banerjee T, Choi IH. Creating elder-friendly communities: Preparations for an aging society. Journal of Gerontological Social Work. 2007;**49**:1-18

[16] Marques da Costa E, Fumega J, Louro A. Defining sustainable

communities: Development of a toolkit for policy orientation. Journal of Urban Regeneration and Renewal. 2013;**6**:278-292

[17] Di Marino M, Tomaz E, Henriques C, Chavoshi SH. The 15-minute city concept and new working spaces: A planning perspective from Oslo and Lisbon. European Planning Studies. 2022:1-24. DOI: 10.1080/09654313.2022.2082837

[18] van Hoof J, Kazak JK, Perek-Białas JM, Peek ST. The challenges of urban ageing: Making cities age-friendly in Europe. International Journal of Environmental Research and Public Health. 2018;**15**:1-17. DOI: 10.3390/ijerph15112473

[19] Lakshmanan CT, Ramachandraiah A, Sivakumar R. Walkability analysis for age friendly neighborhood. Journal of Critical Reviews. 2020;**7**:842-844. DOI: 10.31838/jcr.07.04.158

[20] Banister D, Bowling A. Quality of life for the elderly: The transport dimension. Transport Policy. 2004;**11**(2):105-115. DOI: 10.1016/S0967-070X(03)00052-0

[21] van Staalduinen W, Spiru L, Illario M, Dantas C, Paul C. D4 report on SHAFE policies, strategies and funding. International interdisciplinary network on smart healthy age-friendly environments, COST Action 19136 (2020-2024). NET4Age-Friendly. 2021. pp. 1-153

[22] van Staalduinen W, Dantas C, van Hoof J, Klimczuk A. Building smart healthy inclusive environments for all ages with citizens. In: Pires IM, Spinsante S, Zdravevski E, Lameski P, editors. Smart Objects and Technologies for Social Good: 7th EAI International Conference. Cham: Springer International Publishing; 2021. pp. 255-263

[23] Louro A, Marques da Costa N, Marques da Costa E. Sustainable urban mobility policies as a path to healthy cities—The case study of LMA, Portugal. Sustainability. 2019;**11**:2929. DOI: 10.3390/su11102929

[24] Dickerson AE, Molnar LJ, Eby DW, Adler G, Bedard M, Berg-Weger M, et al. Transportation and aging: A research agenda for advancing safe mobility. The Gerontologist. 2007;**47**:578-590. DOI: 10.1093/geront/47.5.578

[25] Falcão SRA. Autonomia e movimento do corpo idoso: estudo de caso. Lisboa: Universidade Técnica de Lisboa; 2011

[26] van Schooten KS, Pijnappels M, Rispens SM, Elders PJM, Lips P, Daffertshofer A. Daily-life gait quality as predictor of falls in older people: A 1-year prospective cohort study. PLoS One. 2016;**11**:e0158623

[27] Gargiulo C, Zucaro F, Gaglione F. A set of variables for elderly accessibility in urban areas. Journal of Land Use, Mobility and Environment. 2018;(2): 53-66. DOI: 10.6092/1970-9870/5738

[28] Louro A, Marques da Costa N. Mobilidade urbana e municípios saudáveis na AML. Tendências entre as últimas duas décadas (2000 e 2010). Finisterra. 2019;**LIV**:71-95

[29] Marques da Costa E, Palma P, Marques da Costa N. Regional Disparities of SGI Provision. In: Fassmann H. Rauhut D. Marques da Costa, E. Humer, editors. Services of General Interest and Territorial Cohesion: European Perspectives and National Insights Viena: Vienna University Press; 2015. pp. 91-121

[30] Amer S. Towards Spatial Justice in Urban Health Services Planning. A Spatial-Analytic GIS-Based Approach Using Dar es Salaam, Tanzania as a Case

Study. Enschede: International Institute for Geo-Information Science and Earth Observation; 2007

[31] Cuidados de saúde primários [Internet]. 2021. Available from: https://www.who.int/world-health-day/world-health-day-2019/fact-sheets/details/primary-health-care. [Accessed: May 19, 2022]

[32] Marques da Costa E, Marques da Costa N, Louro A, Barata M. "Geographies" of primary healthcare access for older adults in the Lisbon metropolitan area, Portugal—A territory of differences. Saúde e Sociedade. 2020;**29**:1-13

[33] Ferreira R, Marques da Costa N, Marques da Costa E. Accessibility to urgent and emergency care services in low-density territories: The case of Baixo Alentejo, Portugal. Ciência & Saúde Coletiva. 2021;**26**:2483-2496. DOI: 10.1590/1413-81232021266.1.40882020

[34] Penchansky R, Thomas JW. The concept of access: Definition and relationship to consumer satisfaction. Medical Care. 1981;**19**:127-140

[35] Saurman E. Improving access: Modifying Penchansky and Thomas's theory of access. Journal of Health Services Research & Policy. 2016;**21**: 36-39. DOI: 1177/1355819615600001

[36] Freitas C, Marques da Costa N. Accessibility to primary health care in low-density regions. A case study: NUTS III – Baixo Alentejo – Portugal. Ciência & Saúde Coletiva. 2021;**26**:2497-2506. DOI: 10.1590/1413-81232021266.1.40892020

[37] Du M, Cheng L, Li X, Yang J. Mint: Factors affecting the travel mode choice of the urban elderly in healthcare activity: Comparison between core area and suburban area. Sustainable Cities and Society. 2020;**52**:101868. DOI: 10.1016/j.scs.2019.101868

[38] Munir BA, Hafeez S, Rashid S, Iqbal R, Javed MA. Geospatial assessment of physical accessibility of healthcare and agent-based modeling for system efficacy. GeoJournal. 2020;**85**:665-680. DOI: 10.1007/s10708-019-09987-z

[39] Censos. 2021. Available from: https://censos.ine.pt/scripts/db_censos_2021.html. [Accessed: May 15, 2022]

[40] Censos. 2011. Available from: https://censos.ine.pt/xportal/xmain?xpid=CENSOS&xpgid=censos2011_apresentacao. [Accessed: May 15, 2022]

[41] Carta de Uso e Ocupação do Solo para 2018 [Internet]. 2020. Available from: https://www.dgterritorio.gov.pt/Carta-de-Uso-e-Ocupacao-do-Solo-para-2018. [Accessed: May 07, 2022]

[42] Diário da República n. 38/2008, Série I de 2008-02-22 – Estabelece o regime da criação, estruturação e funcionamento dos agrupamentos de centros de saúde do Serviço Nacional de Saúde [Internet]. 2008. Available from: https://dre.pt/dre/detalhe/decreto-lei/28-2008-247675. [Accessed: May 26, 2022]

[43] Cuidados de Saúde Primários [Internet]. 2022. Available from: https://www.arslvt.min-saude.pt/pages/6247675. [Accessed: May 06, 2022]

[44] Beard JR, Petitot C. Ageing and urbanization: Can cities be designed to Foster active ageing? Public Health Reviews. 2010;**32**:427-450

[45] Louro A, Marques da Costa N, Marques da Costa E. A Cidade Saudável no planeamento municipal: exemplos de atuação na AML, Portugal. In: Soares BR,

Marques da Costa N, Lima SC, Marques da Costa E, editors. Construindo cidades saudáveis: utopias e práticas. Uberlândia: Assis Editora; 2017. pp. 35-66

[46] Câmara Municipal da Amadora. VIVER BEM A IDADE – Plano Estratégico para o Envelhecimento Sustentável da Amadora 2016-2025. Amadora: CMA; 2021. p. 11

[47] Idosos vacinados contra a gripe em Lisboa sem terem de se deslocar ao centro de saúde [Internet]. 2020. Available from: https://dignus.pt/2020/09/23/idosos-vacinados-contra-a-gripe-em-lisboa-sem-terem-de-se-deslocar-ao-centro-de-saude/. [Accessed: May 19, 2022]

[48] Cinco apoios sociais para quem vive em Oeiras [Internet]. 2020. Available from: https://www.oeirasvalley.com/cinco-apoios-sociais-para-quem-vive-em-oeiras/. [Accessed: May 19, 2022]

[49] Transporte solidário para idosos – Serviços da Junta [Internet]. 2021. Available from: https://www.jf-carnide.pt/para-a-populacao/servicos-da-junta/servicos/Transporte-solidario-para-idosos/291/. [Accessed: May 19, 2022]

[50] Serviço de mobilidade inclusiva "Almada BUS Saúde" atinge os 500 mil utilizadores [Internet]. 1999. Available from: https://www.ageneal.pt/noticia/servico-de-mobilidade-inclusiva-almada-bus-saude-atinge-os-500-mil-utilizadores. [Accessed: May 19, 2022]

[51] Portal Viva. Passes Navegante [Internet]. 2022. Available from: https://www.portalviva.pt/pt/homepage/t%C3%ADtulos-de-transporte/uso-frequente/passes-navegante.aspx. [Accessed: May 01, 2022]