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15-Minute City concept for healthy tourism during the COVID-19 pandemic crisis. Who for? The city of Lagos, Portugal

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ABSTRACT

Urban spatial organization provided an important contribution for healthy tourism in the first COVID-19 pandemic period. The 15-Minute City concept promotes walking which is essential for the development of outdoor activities for a healthier tourism. The tourist city of Lagos (Portugal) is a pilot city of the Interreg Med SuSTowns Project which aims to promote sustainable and resilient territories. This study presents an analysis of the pedestrian accessibility through a specific geographical indicator: the percentage of short-term rentals existing in the surrounding tourist attractions. Ideal standard distances, studied internationally, were considered to assess this close proximity. Different walking speeds were considered to address human diversity and their implications on the 15-Minute City concept. The functionalities of the geographic information systems, in particular the assessment of distances over the pedestrian network were used. The results indicate that in the city of Lagos there is a trend towards an effective 15-Minute City for healthy tourists, promoting walking which could enhance tourism attraction. For tourists with reduced mobility, the use of accessible public transportation is required and needs to be integrated in the 15-Minute City concept.

KEYWORDS

15-Minute City, Walking, Pedestrian Accessibility, COVID-19 Pandemic Crisis, Healthy Tourism, Tourists with Reduced Mobility, Lagos' City.

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1. Introduction

Urban spatial organization provided an important contribution for healthy and sustainable mobility in the first COVID-19 pandemic period that occurred in 2020, in Europe. The 15-Minute City concept, fueled during the COVID-19 pandemic and developed by Carlos Moreno, puts forward a human-scale proposition for how cities have to be planned to change people's mobility and lifestyle during the pandemic. The goal is to give people access to all necessary destinations within 15 minutes from their homes walking or cycling. This is an urban set-up where locals are able to access all of their basic essentials at distances that would not take them more than 15 min on foot or by bicycle (Moreno et al., 2021).

Based on the review of existing ±15-Minute City studies, the European Institute of Innovation and Technology developed eight associated planning principles: a) Proximity to essential services; b) Proximity to public transport; c) Density; d) Mixed land use; e) Walkable and cyclable streets; f) Liveable public spaces and placemaking; g) Inclusiveness; and h) Ubiquity (EIT Urban Mobility, 2022). This human-centred planning promotes human interaction within local environments. Walking or bike distance accessibility to basic facilities is a prerequisite to avoid excessive movement of people within the main road network (Pisano, 2020).

Since the 1990s, some of these attributes have been discussed around the development of sustainable cities, mainly with the promotion of soft modes and public transportation, in an urban context, linked with low carbon and healthy mobility, e. g. sustainable mobility. The concept of "sustainable mobility" is associated with sustainable development, applied to transport activity, and, therefore, considers environmental protection, social equity and economic development. It, inevitably, implies the necessity of using pedestrian and cycle modes and addressing human diversity. Active travel is considered a sustainable form of urban mobility that is equitable, affordable and inclusive (Grow et al., 2008) and it is significant to today's urban society (Pajares et al., 2021).

At the local level, to meet sustainability, emphasis is placed on an urban design that considers the pedestrian at the top of the access hierarchy, so that people, as residents or as tourists, can make an effective choice. Compact cities and the diversity of land use are promoted, that is, urban mixed use. However, from the tourism planning and management perspective little is known about the use of the ±15-Minute City concept and related concepts of pedestrian accessibility and the role of hotels and short-term rentals in creating sustainable and livable tourist cities. Considering this gap in literature, in the present research, this close proximity strategy is presented through the tourism perspective, defending that the proximity of tourist attractions in relation to short-term rentals, can contribute to shorter trips, making it easier to choose the pedestrian mode.

Accessibility refers to the ability to reach desired goods, services, activities and destinations, i.e. opportunities (Litman, 2021). This accessibility refers to physical dimension. Land use proximity is one of the factors that can affect accessibility and is related with density and mixed urban developments, and, therefore, shorter distances between activities. The "short distance" indicator is crucial to promote good levels of pedestrian accessibility and a proximity urbanism (Rosa et al., 2018).

In the scope of the present study, the argument is that the indicator "short distances" is determinant to promote a healthy tourism in the first COVID-19 pandemic context, as it is associated with the 15-Minute City concept and the associated pedestrian accessibility, and, therefore, contributes to a tourism of proximity. Walking can provide the opportunity to maintain social distancing practice, i. e., the two metres (six feet) rule.

This case study is developed considering the tourist city of Lagos, located in the south of Portugal, in the Algarve Region. This historical and cultural city was one of the pilot cities studied under the Interreg Med SuSTowns Project – Sustainable Tourism in small and fascinating villages in the Mediterranean area – which aims to promote sustainable and resilient territories. This study was developed, too, in the context of the project Summer with Science - Accessible and Inclusive Project (2020) supported by FCT-Foundation for Science and Technology. It is intended to study accessibility through the construction of a geographical indicator: the percentage of short-term rentals that exist in some served areas of tourist attractions. Analysis considers the accessibility to touristic points of interest, considering ideal standard distances studied internationally and different walking speeds to address human diversity, for example,

tourists with reduced mobility.

For the analysis of the proximity between the short-term rentals and the tourist attractions, the functionalities of the geographic information systems were considered, in particular in the calculation of distances within the pedestrian network.

2. Literature Review

2.1 The Promotion of Walking as a Mode of Transportation during the COVID-19 Pandemic Crisis

The Covid-19 pandemic has affected and transformed many aspects of human life, including transportation and work (Bornioli, 2022). The fact is that Covid-19 is highly pathogenic in public transport environments (Shen et al., 2020) and this factor revealed the weak points of the transport system and created a great challenge regarding travel, mobility and public health (Tarasi et al., 2021). People considered public transport as dangerous and its use became negative in people's opinion (Genitsaris et al., 2021). The number of public transport passengers in European cities decreased by 80% due to the reduction of public transport operator services (Das et al., 2021). As a result of this process, the face of urban transportation changed, which led to a change in the behaviour of all citizens and transformed their travel patterns (Tarasi et al., 2021). This change can be seen in the report of the International Association of Public Transport, which considered one of the main challenges related to the resumption of public transport, the provision of high quality services to ensure the observance of a safe distance (Gkiotsalitis & Cats, 2021).

The issue of transportation and Covid-19 has affected various aspects of people's lives and work, among which the tourism industry can be mentioned as one of the most important sources of income for many countries in the contemporary.era

Tourism, which has different local, regional, national, and international scales, is especially dependent on the movement of people, or in other words, transportation. In fact, to be successful in tourism, having proper transportation is a basic need, a central and dynamic element, so that during the last decades of the 20th century a significant growth in transportation for tourism occurred (Lumsdon, 2000). This relationship, which is mostly investigated by geographers, finally connects tourism with the subject of the tourist destination (Lew et al., 2008).

Tourism, as a phenomenon related to space with a great impact on society and the national economy during the Covid-19 pandemic (Roman et al., 2020), is one of the most important activities that have been severely affected by the spread of this disease. It has caused long-term changes among visitors by reducing the ability and desire of people to travel, influenced visits and related activities (Delclòs-Alió et al., 2022) and hence has highlighted the importance of organizing tourist trips and factors related to them (Roman et al., 2020).

Due to their limited indoor space, public vehicles were an ideal space for the transmission of infectious diseases amongst humans (Shen et al., 2020) providing crowded and unhealthy transportation. The requirements of social distancing caused by Covid-19 and the necessity of people commuting, in general, and tourists, in particular, highlighted the issue of focusing on the strategy of walking in cities or urban walkability. Also, the existence of some evidence regarding the relationship between environmental factors and physical activity led to the focus of a large part of research on walking (Cerin et al., 2007).

It seems that the existence of previous approaches in the field of new urbanism emphasizing the development of neighbourhoods for pedestrians (Audirac, 1999) has been a great help in the development of pedestrian-based thinking in cities in relation to tourism, too. The choice of transportation options for people is linked to their level of ability, but in almost all trips, either mandatory or optional, a part of the movement is dedicated to walking, which can also be called multimodal walking (Dihingia et al., 2022).

The impact of the restrictions considered to reduce the effects of Covid-19 on the walking behaviour of the community is undeniable (Hunter et al., 2021) and it seems that by studying different societies, different reactions can be encountered, and even studying different sources shows differences in terms of definitions related to walking (Nordin & Jamal, 2021). However in terms of tourism, this issue may be clearer as walking can be seen as an activity that is popular among tourists (Delclòs-Alió et al., 2022). If we

consider tourism and recreation as a form of therapy (Buckley & Westaway, 2020), focusing on tourism with urban transportation oriented towards walking as one of the most basic forms of human mobility (Hannam et al., 2021). Walking can provide prosperity and an opportunity to think and rest (Bornioli, 2022), and be an active transportation method (Dihingia et al., 2022) supporting complete, sustainable and healthy cities (Kamelifar et al., 2022).

Therefore, walking and cycling in cities was considered with the aim of increasing resilience in the era of the Covid-19 pandemic (Paydar & Fard, 2021) and the concept of the 15-minute city was expanded in response to this situation, which is actually a type of proximity-based planning that citizens can get the services they need within a 15-20 minute walk (Lotfata et al., 2022).

Engaging contemporary cities with covid-19 and testing their resilience in this process, the concept of the 15-minute city as a supporter of the positive impact of proximity-based planning on releasing cities from the domination of cars, shined brighter (Allam et al., 2022). When the reduction of car dominance in cities is discussed, the tendency towards the concept of scale in cities can be followed, because the walkable city is basically intertwined with the issue of distance and, in light of that, with the concept of time. So basically, the 15-minute city can be described with the concept of scale. This issue of scale is considered an important element in urban planning, and in fact, a neighbourhood will be complete when it can meet the people's requirements on a human scale at different ages and with different abilities in the form of walking and cycling capabilities (Pozoukidou & Chatziyiannaki, 2021). Among the ideas that can affect people's habits in cities is planning to live and work at a suitable distance that provides opportunities for walking and cycling, which in this case can affect people's movement patterns and, in addition, change the use of urban spaces (Di Marino et al., 2023).

The ±15-minute concept is operationally viable for urban centres or even small towns which are able to offer greater variety in a tighter space as part of their mixed-use zoning strategies in downtown areas and its model is viable in neighbourhoods in big cities (EIT Urban Mobility, 2022). Concerning metropolitan cities, an efficient connectivity between neighbourhoods is crucial through public transportation. Public transit is necessary to access spatially distributed opportunities at the local or city level and so, Papadopoulos, Sdoukopoulos and Politis (2023) suggested it be considered within the 15-min city concept. In consequence, the 15-minute city concept can play an important role in bringing together multiple spatial dimensions related to the well-being of people and the environment (Marchigiani & Bonfantini, 2022).

2.2 Close Proximity of Urban Land Uses

The concept of accessibility is strongly linked to a broad set of measurable indicators (Geurs & Van Wee, 2004; Scheurer & Curtis, 2007). Accessibility involves four inter related components: transport, land use, temporal and individual components (Geurs & van Eck, 2001). The transport component refers to the transport infrastructure, location and characteristics, and also to the demand and usage, travel time, costs and efforts to reach a destination. The land use component consists of the locations and characteristics of demand and opportunities, and the temporal component of accessibility is related to the availability of activities at different times (of the day, week, and year). Finally, the individual component refers to social and economic characteristics and people's needs, abilities and opportunities. In general, the selection of the measurable indicators would vary with perspectives, the scale of the analysis, and with the available data.

Urban land use structure has a strong influence on demand management of motorized vehicles and also influences pedestrian and cycle accessibility. The interactions between transport and land use are intrinsically related to residential densification, employment concentration, urban design, spatial orientation of urban sprawl, accessibility and the cost of transport (Wegener & Fürst, 1999).

Traditionally, the spatial distribution of the residential areas were characterized as constituting a mono or polynucleated concentration or a dispersed one. In terms of land use intensity, it is associated with high density or low density. High density generally generates an adequate supply of collective transportation. In monofunctional residential areas, there tends to be a greater dependence on individual motorized means of transport.

The urban areas with a high concentration of activities, that is, having mixed urban uses, encourages a town to maximise the use of soft modes. The urban design influences the physical and functional qualification of urban spaces, which is a fundamental issue in the field of pedestrian and cycling infrastructures

in order to promote their use.

The dominant pedestrian destinations are generally places where concentration of employment, commerce and leisure occurs. Thus, high quality pedestrian networks should be created, particularly between key destinations such as residential areas, schools, shopping areas, bus stops, stations and workplaces. In the context of tourist cities, where tourists could be mainly walkers, key destinations are cultural and tourist attractions, hotels and short-term rentals, and the referred shopping areas, bus stops and stations, among others.

According to Barton, Davis and Guise (1995) designing cities for accessibility means ensuring that there is a true choice of modes of transport to meet different needs, and that the location of facilities should be as convenient as possible. When planning new service locations, the distance between two destinations should be short and make it feasible for an opportunity and incentive to use soft modes and public transport in that area. There should be alternative routes and different modes of transport available between two destinations. The movement of people refers to the fact that they want to reach places, which makes their location a very important factor in accessibility, as well as the quality of transport and the route used to reach those places.

In the United Kingdom and the United States of America, a 400 or 600m standard is widely applied for access to local facilities/services as well as for bus services. Barton et al. (1995) recommend standards for a wide range of local facilities to likely catch populations: for example, the distance suggested for bus stops is 300-400m, for train stations is 600-800m, for health centres is 800-1000m, for secondary schools is 1000-1500m, for primary schools is 400-600m, for local shops 400-800m. The starting point is the spatial relationship between the residences and the location of facilities/services. It is desirable that 80% of homes should achieve those distances, minimizing travel lengths, making it easier to travel on foot or by bicycle, thereby increasing sustainable mobility.

2.3 Travel Impedance Considering Human Diversity

Another easy accessibility standard is the travel impedance, as seen through the 15-Minute City concept during the COVID-19 pandemic. The impedance between origins and destinations is operationalized by measuring travel time along the street network. However, the distance covered along the street network in 15-minutes depends on the traveller's speed, which may be influenced by age or the topography (Hosford et al., 2022).

In general, the average walking speed is suggested to be 5 km/h, or 1.4 m/s, which equates to approximately 400m in five minutes (Institute of Highways and Transportation, 2000). However, Barton et al. (2010) recognize that individual speeds vary widely in the range of 3.2-6.4 km/h. In the United States, the Transportation Research Board (2016) proposes walking speeds of 4.8 km/h for younger pedestrians (<65 years) and 3.6 km/h for older pedestrians (≥ 65 years). According to Alves et al. (2020) the estimated walking speed of adults over 65 differs between authors, from 2.16 km/h to 4.34 km/h. Concerning children, the walking speed is about 2.8 km/h at 2 years of age and increases progressively with age up to 5 km/h at 12 and in adults (Cavagna et al., 1983).

Considering other people with reduced mobility, the average walking speeds of a freely moving elderly person, a male using crutches, and a female using crutches are in the range of 2.27-4.86 km/h (Shi et al., 2009). Considering people with disabilities, the walking speed range is from 0.36 km/h to 7.1 km/h (Shi et al., 2009). So, all these examples show that people with reduced mobility, such as persons with disability and older people, are slower compared to that of a healthy younger person (5 km/h).

In consequence, the 15-Minute City concept, usually associated with inclusiveness, infers a broad range of walking distances considering the human diversity from 150m to 1600m (Table 1). In fact, human diversity has been discussed in the context of universal and inclusive design of the built environment and transportation systems.

Table 1. Walking Distances by People Groups Considering the 15-Minute City Concept

People groups	Gait speed (km/h)	Walking distances (m) in 15 minutes
Younger and healthy adult	6.4	1600
Younger age-group pedestrian (< 65 years)	4.8	1200
Children (2 years)	2.8	700
Older age-group pedestrian (≥ 65 years)	1.2	300
People with significantly reduced mobility	0.6	150

Source: Own Elaboration

The distance-time to overcome two points can be measured in a simple straight line (Euclidean distance) or by considering the street network to give a more accurate assessment of the distance/time between two locations (Silva et al., 2020).

The 15-minute city concept requires conditions in the use of urban land to be such that, the general conditions of the city supports all concerned, including residents, those who enter the city for any reason, and tourists in line with the goals of this type of city. If the 15-minute city concept is designed specifically for tourism, it can be planned more favorably for tourists to access the facilities, services and places for which they have come to the city.

2.4 Short-term Rentals

There are residential units that are usually rented or leased for less than 30 days and are referred to as short-term rentals (STR) that people voluntarily share their goods and services for a short period of time (DiNatale et al., 2018). This concept is not a new phenomenon related to recent years, but currently there is a set of scientific knowledge in this field that is mostly focused on tourism and housing (Combs et al., 2020). Usually STR's units can have different types of accommodation: shared rooms, private rooms or entire apartment/houses. In Portugal, STR establishments can take the form of rooms, villas, flats and lodging establishments - including hostels (INE, 2021).

Short-term rentals can enhance cultural heritage tourism by providing authentic local experiences, which are increasingly sought after by travelers looking for immersive experiences, to get an authentic view of the city they are travelling to (Angel & Doganer, 2020). Considering the period 2014 to 2019, O'Neill and Yeon (2021) note that the growth of STRs were particularly pronounced in urban areas.

In fact, in tourist cities, STR have become a significant part of the hospitality ecosystem, influencing both the local economy and the housing market. The demand of STRs is associated with the use of digital accommodation platforms. These digital platforms are associated with certain groups of tourists, such as young people, technologically comfortable tourists and/or budget-conscious tourists (Guttentag, 2015). This aligns with findings from Soh and Seo (2021) that specify that Airbnb customers are generally perceived to be younger, adventurous, and tech-savvy individuals who are looking for more authentic travel experiences offered by STRs. The rise of platforms, like Airbnb, has catered to this demographic by providing authentic, off-the-beaten-path experiences that traditional hotels may not offer (Nieuwland & Melik, 2018).

But the profile of users engaging with short-term rentals is diverse, shaped by various travel preferences, needs, and expectations. Another significant aspect of the STR market is the demographic profile of its users. Soh and Seo (2021) report that approximately 70% of vacation rental listings on major short-term vacation rental booking platforms are two- or more-bedroom properties with an average capacity of six people, suggesting that families and larger groups prefer STRs due to the availability of multi-bedroom properties.

Nelemans (2021) has presented interesting statistics on Airbnb and hotel users: users between the ages of 25 and 40, with an average age of 33, are the largest group of Airbnb users, while the average age of hotel users is 44. Another interesting point that casts doubt on the assumptions is examining the income of users. While it is expected that hotel users are from a higher income group, this is not the case,

and Airbnb users, which are known as cheaper accommodations, are from a higher income group than hotel users. Therefore, it should be noted that in identifying the user profile, other reasons should be sought, which are sometimes more important, besides income.

Additionally, according to Bresciani et al. (2021), in a pandemic situation, the type of full flat/house renting of peer-to-peer accommodation types often requires no interaction with others, and allows for full social/physical distancing from other individuals, especially if it is an isolated structure, therefore, travellers tend to choose a full flat accommodation over hotels and shared flats.

2.5 Measuring Pedestrian Accessibility through Geographic Information Systems

Today's geographic information systems (GIS) provide capabilities that enable the creation of spatial databases and the implementation of geoprocessing operations, as well as a wide range of tools for collecting, analyzing and viewing geographic information. The multilayer organization allows the accomplishment of spatial analyzes relating the data of the above components involved in the concept of accessibility, by its geographical position. The production of maps provides tools for analyzing spatial distributions of accessibility indicators, and their relationships with other data. With these characteristics, GIS are suitable tools for accessibility studies at different levels, urban, regional and national, and in different perspectives (Huang & Hawley, 2009).

At the urban level, the walking infrastructure is often represented by a pedestrian network using street center line data, and, to measure spatial separation between origins and destinations or between nodes, the network distance is used (Scheurer & Curtis, 2007). The distance between two points is defined as the length of the shortest path on the network that connects those points, one taken as the origin and the other as destination, and its value can be computed by a GIS software such as ArcGIS Desktop with the Network Analyst extension. Even though one (or both) of the points does not lie over the network. In this case, the network is dynamically extended by adding an arc connecting this point to the closest arc of the network. One of the available tools of this GIS software allows to compute the origin-destination matrix (O-D Matrix), where the rows represent the set of origin points, the columns the set of destinations points and elements of the matrix the distance between each pair of points.

Contour measures allow to compute the catchment areas around a node or a point that enables the counting of the number of a specific type of opportunity within each contour (Geurs & van Eck, 2001). For example, the number of young inhabitants near a school, or the number of buildings close to a bus stop. This measurement is implemented in the Service Area tool of the Network Analyst extension. Given a set of points (services), a network and a distance, this tool identifies the part of the network within the distance from at least one of the services, and generates a polygon. The type of polygon generated (catchment area) is not however suitable for urban scale (Achuthan et al., 2007), thus it should not be used to overlay other layers and to count opportunities. Instead of overlaying, the O-D matrix can be used to identify and/or count all the origin points (opportunities) within a given distance of a specific destination (service).

3. Methodology

Based on what was mentioned earlier, during the early period of the COVID-19 pandemic, many travelers opted for STR to minimize contact with people and maintain physical distancing. So, this study investigates the localization of these types of residences, specifically, and the localization of tourist attractions. Therefore, 14 cultural tourist attractions were the focus of the facilities' accessibility in Lagos city.

GIS is an essential tool to supply measures describing the level of accessibility to spatially distributed activities, such as touristic facilities. With this tool, the results can be well visualized, easily understood and interpreted by urban planners, policy makers and businessmen. Local accessibility must be considered a high priority for service providers.

The development of the present work was done using databases with varied information collected from the OpenStreetMap (OSM) (OpenStreetMap contributors, 2020) and the Tourism Geographic Information System (SIGTUR), a platform developed by the National Tourism Board (Turismo de Portugal, 2020).

The road network dataset was created from data extracted from OpenStreetMap (OSM). Its purpose is to represent the pedestrian network within Lagos city (study area). This pedestrian network was topologically corrected for the purposes of network analysis. No spatial or attribute accuracy analysis were done on the original dataset.

Since this study focuses on the pedestrian network and in the study area there are no roads where the pedestrians are prohibited (e. g. highways) the whole network was used without any restrictions.

Therefore the short-term rentals dataset was created from data extracted from SIGTUR. The georeferencing of the short-term rentals is automatic, obtained from the SIGTUR (2020). No spatial or attribute accuracy analysis were done on the original dataset.

Through geographic information systems (GIS), using the ArcGIS® software by Environmental Systems Research Institute (ESRI, 2020), an analysis was developed of the geographical distribution and pedestrian accessibility of touristic attractions that the city of Lagos offers to its tourists, considering internationally studied standard distances.

The standard distance of 600m and some other walking distances were considered to take into account different groups, to analyse the inclusivity of the 15-Minute City concept.

4. Case Study: Pedestrian Accessibility in the Touristic City of Lagos

4.1 The Municipality and the City of Lagos

The municipality of Lagos is located in the south of Portugal (Figure 1) which is in the south-west of Europe. It is of great tourism importance and is integrated within the region of the Algarve. It has an undeniable Mediterranean climate, ideal for walking and cycling.

The city of Lagos, known as the city of Discoveries, is located in the south-east of the municipality (Figure 2). The urban beaches and the historical centre are reference points for tourists which are walkable and guided through pedestrian infrastructures. The city is crossed by a small river (Ribeira de Bensafrim) and has a Marina, a prominent place in the city. Along the river wetland regions and salt marshes can be found. As a coastal city, the rock surrounded beaches are an attraction point, making this city a reference point in the region for Tourism. The municipality has a resident population of 33494 (INE, 2022).

Prior to the COVID-19 crisis the municipality received thousands of tourists. Even in the summer of 2020, many tourists, mainly Portuguese people, visited Lagos, through important roads, as the Average Daily Traffic can prove - a measure used to understand the intensity of the vehicle traffic. This data can be used for the identification of the levels of attractiveness of the territories with good road accessibility. In fact, Rosa (2022) presented an analysis of the effects of the COVID-19 pandemic on the road traffic of the Algarve Region and in the municipality of Lagos, in particularly. When considering highway A 22, the road session between Bensafrim and Lagos, the study presented an analysis of the Average Daily Traffic of 2020 in August (6 731vehicles per day) compared with the average number that occurred between 2012 and 2019 (6 378 vehicles per day), where there was an increased number of motor vehicles (+5.5%), the biggest on the main important roads located on the Algarve coast. Data of road traffic volumes were obtained from the sites of Portuguese institutions responsible for transportation. The results prove that, in Lagos, there has been a phenomenon of proximity tourism during the summer of 2020.

In fact, when considering the number of overnight stays, that is, nights spent by tourists at tourism establishments, this is an indicator commonly used by territories to more effectively assess the evolution of the tourism sector and the impact on it. In Lagos, the demand for tourist accommodation, reached a value of 526174 overnight stays in 2020 and so, the Tourist Intensity Index is much higher than in Portugal and similar to the Algarve (Table 2).

Table 2. Tourist Intensity Index

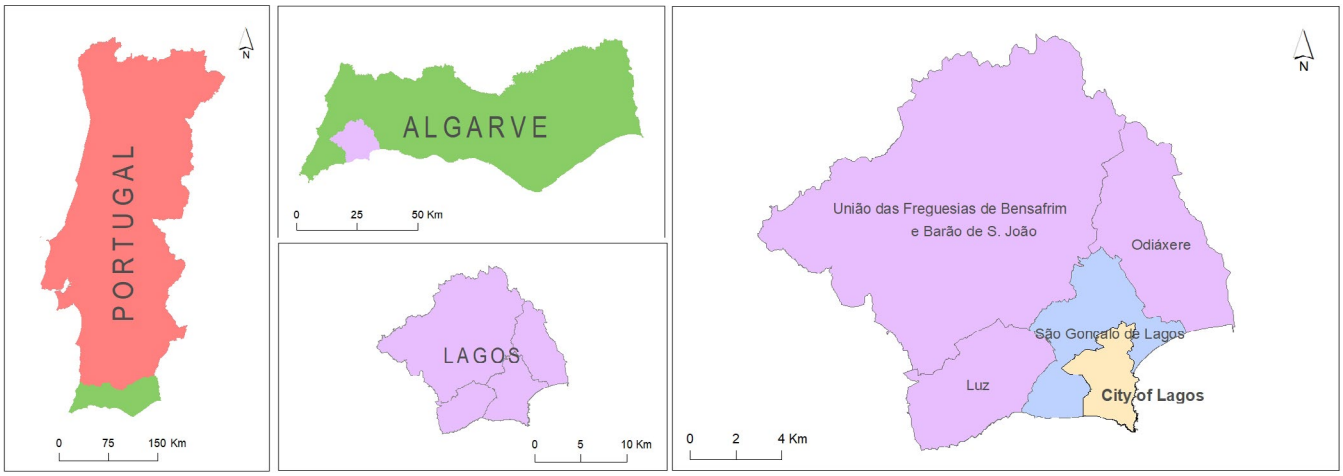
	Number of residents 2021 (INE, 2022)	Number of nights in Tourist Accommodation establishments/Annual 2000 (INE, 2024)	Tourist Intensity Index*
Portugal	10.343.066	25.798.299	0.7
Algarve	467.343	7.890.711	4.6
Lagos	33.494	526.174	4.3

*((Annual overnight stays/365)/Total resident population) *100
Source: Own Elaboration

The main avenue (Avenida dos Descobrimentos) follows the river to the sea and has beautiful landscapes. Along this avenue, many small kiosks are found selling souvenirs as well as promoting private maritime-touristic activities. Nearby, there is an underground car park with capacity for approximately 170 cars. On the river, especially in the morning, the nautical traffic can be very intense. This avenue is connected, by a moveable bridge, with the Lagos Marina, a blue space associated with a tourist and high urbanized area, close to the railway station. This bridge allows the passage of pedestrians.

The City Park, a Mediterranean garden, is located in the city centre and it is surrounded on one side by the city walls. This green park is an inviting area, used for recreation and leisure activities. Below the park, an underground car park with capacity for approximately 400 cars can be found. There are some touristic places nearby such as historic monuments and a mini-golf centre. These characteristics have the potential to attract people to the area.

Figure 1. Portugal Map and the Location of Lagos Municipality



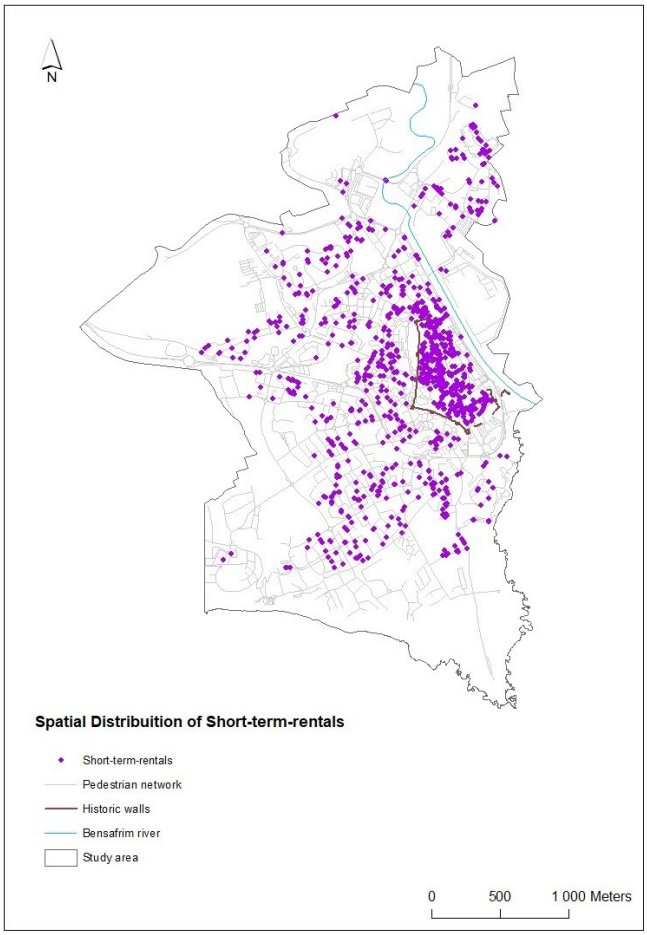
Source: These maps were produced based on Official Administrative Map of Portugal - CAOP 2019, open data provided by Direção-Geral do Território (DGT, 2019)

In terms of tourism supply, in July 2020, according to the National Tourism Registry (Turismo de Portugal, 2020) the municipality offered around twelve thousand beds, considering hotels, hotel-apartments, tourist apartments, tourism villages, rural tourism, camping and caravanning. Most of these tourist enterprises have the seal of a Health & Safety Establishment, created by Turismo de Portugal, which contributes to the perception of a safe destination from the pandemic situation.

In the municipality of Lagos there are 4400 short-term rentals with a capacity for 23 thousand users, distributed by different typologies: apartment (65%), house (27%), room (1%) and accommodation establishments (7%). Inside the city of Lagos (the study area) there are 2246 Short-term rentals with capacity for 11775 users (Turismo de Portugal, 2020).

Figure 2 shows the spatial distribution of short-term rentals located in the city of Lagos.

Figure 2. Spatial Distribution of Short-Term Rentals in the City of Lagos



Source: This map was produced based on SIGTUR (2020) and OpenStreetMap contributors (2020)

The distribution of short-term rentals is strongly related to the urban expansion of the city during the latter decades of 20th century. The sea boarder of the city of Lagos in the southeast and south is the biggest natural factor limiting the physical growth of the city and has played an important role in its spatial structure. On the other hand, the formation of the Bensafrim river in the east, which is a combination of natural and human factors, has limited the development of the city to that side, so the urban expansion occurred towards the west. The highest density of short-term rentals is found in the historic centre and decreases towards the west of the city.

4.2 Strengths and Limitations of the Research

Usually, proximity tourism's studies are developed considering social inquiries regarding the mobility of tourists. The present study gives innovative information related to spatial distribution of short-term rentals and the pedestrian accessibility to tourist attractions for tourists who stay there.

This study has some limitations, such as, the location of some short-term rentals shows some small errors in the perceived location, as some units are within a building and to be visualized, the spatial data allocates them to be in an area close to the building in question. The system assumes some mistakes in terms of georeferencing.

In 2020, in the city of Lagos there were 2246 short-term rentals with a capacity for 11775 users, but the network analysis only locates 2104 because there are situations where access routes to these accommodation units are not identified or the routes that exist do not connect to the remaining ones within the study area.

Another limitation is the existence of another kind of typology of tourist supply such as hotels, hotel-apartments and tourist apartments that were not considered in the present research, because they

do not have the formal classification of short-term rentals, listed in Turismo de Portugal (2020). In the present study, short-term rentals were considered as allowed for isolation and strong physical distancing from other people, an important criterion in the COVID-19 pandemic crisis context.

The pedestrian accessibility only considers the measure of walking distances, but there are other conditions that affect the mobility of pedestrians, e. g. gradients of the streets, weather conditions, stairs or other barriers in the streets, etc. These will also affect the distances people are able to walk. According to Alves et al. (2020) elderly people need adequate walking paths, i. e. "heart-friendly route" without significant gradients and stairs.

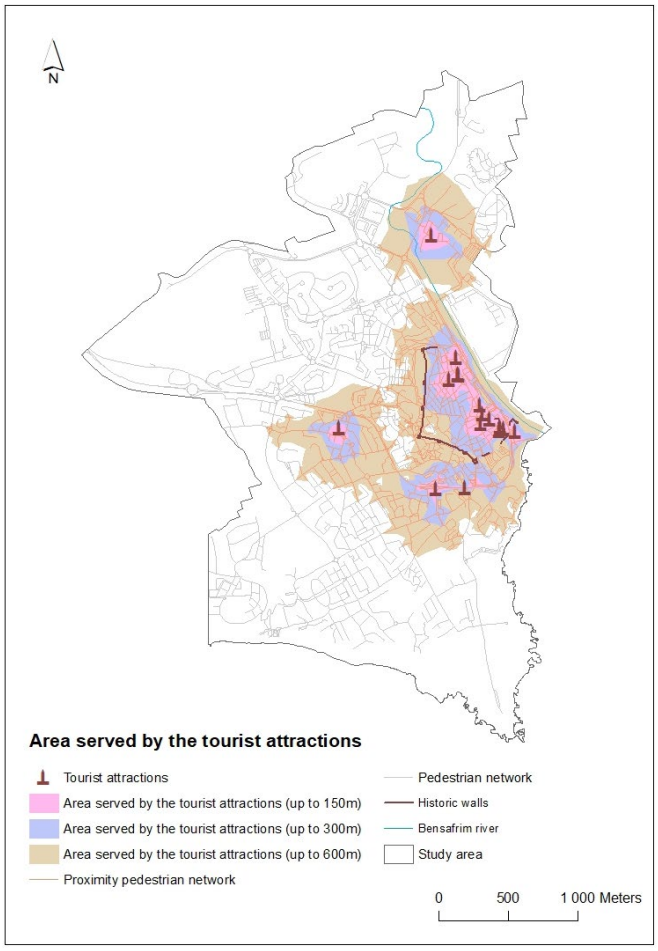
It is suggested that complementary studies should be carried out, to provide a wider and deeper understanding of the means of transportation used by tourists in this pandemic crisis.

5. Results

5.1 Accessibility to Cultural Tourist Attractions

The location and distribution of the most important tourist attractions in the city of Lagos are shown in Figure 3. The majority are located in the historic centre. The closest area served by the tourist attraction can be seen, corresponding to the standard distance of 600m, considering three different zones: the area served by the accessibility of up to 150m from the referred short-term rentals (in pink); the area served by the accessibility of the range 150-300m (in blue) and the area served by the accessibility of the range 300-600m (in brown).

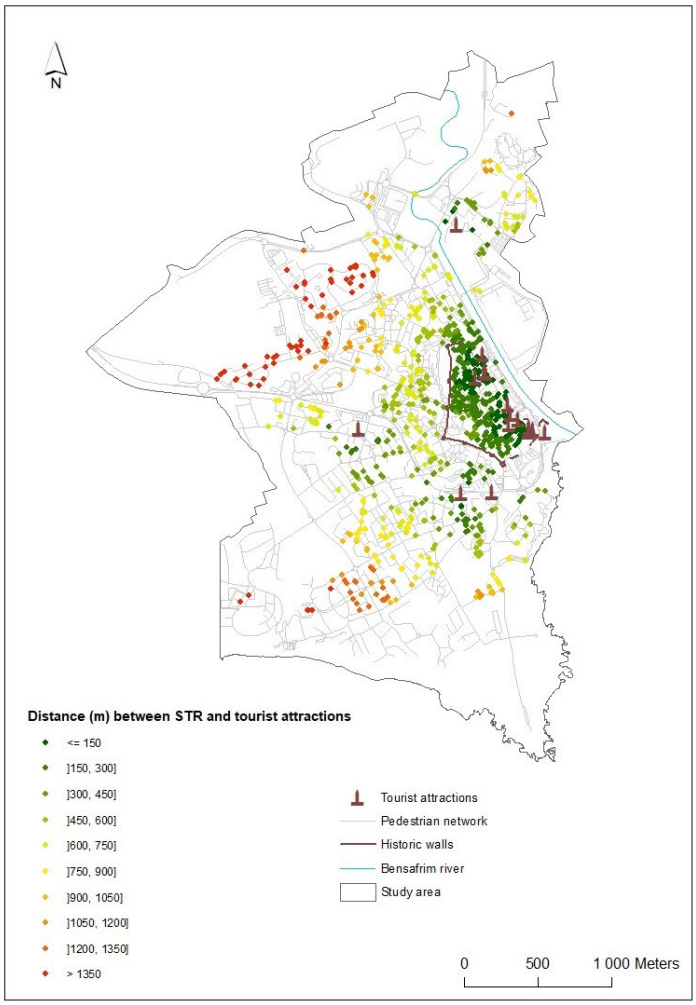
Figure 3. Close Area Served by the Tourist Attractions in the City of Lagos



Source: Own Elaboration. Contains OSM data © OpenStreetMap contributors (2020)

In Figure 4, the short-term rentals with the closest proximity to tourist attractions are represented in green tones (distance up to 600m), units located an intermediate distance are represented in yellow (distance between 600 and 1000m) and units farther from tourist attractions are represented in orange/red tones (distance greater than 1000m). A high density of short-term rentals in the historic centre can be seen. The density decreases with the peri-urban areas.

Figure 4. Accessibility to Tourist Attractions

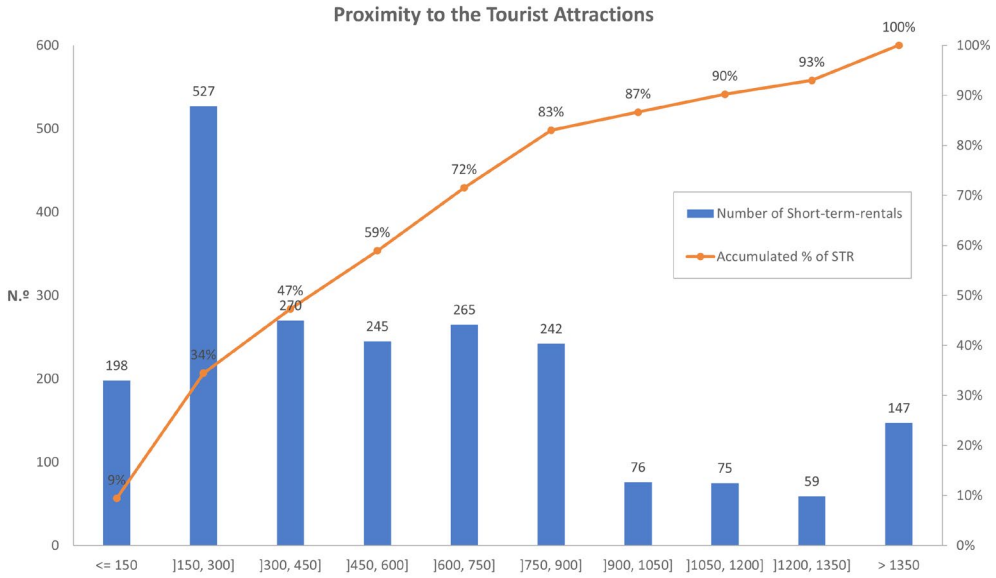


Source: Own Elaboration. Contains OSM data © OpenStreetMap contributors (2020) and data from SIGTUR (2020)

As a result of the accessibility to tourist attractions in the study area, it was found that for tourists staying in short-term rentals, there is a provision of this type of attraction at an average distance of 576m from their accommodation (a value less than the standard distance of 600m), with the furthest short-term rentals being 1960m away. The standard deviation value found for these distances was 422m.

Figure 5 shows the values of accessibility to tourist attractions in the study area, for the short-term rentals, according to distance classes, as well as the cumulative percentage. Thus, it is observed that for short-term rentals, 9% are close to tourist attractions within 150 m distance and that 59% have a tourist attraction up to the standard distance considered (600 m). 90% have a tourist attraction up to a distance of 1200m, that is to say, for younger pedestrians (under 65 years old) this distance is covered very easily.

Figure 5. Pedestrian Accessibility between Short-Term Rentals and Tourist Attractions in the City of Lagos



Distance (m) between Short-term-rentals (STR) and tourism attractions
Source: Own Elaboration

5.2 Discussion

One of the most common activities among tourists is walking, providing visitors with a range of different experiences of the places they visit (Dihingia et al., 2022). Visitors can gain experiences by walking through different parts of the city. Davies (2016) believes that walking along significant routes is effective in increasing the overall experience of tourists. This can be achieved when the destination of tourists has the necessary capacity for walking, in other words, walking should attract tourists like a magnet to experience the place, and in touristic cities, it should be such that they experience these spaces on foot (Hall & Ram, 2018). So, the 15-minute city concept, usually for residents, can be considered from the perspective of tourism, where visitors can access most of their needs within a 15-minute walk or bike ride from their accommodation.

Considering the city of Lagos, most of the cultural tourist attractions are located in the historic centre. This central area integrates a high density of short-term rentals, too. Findings show that the density of short-term rentals decreases with the peri-urban areas.

The city of Lagos has an urban form and dimension that enables younger and healthy tourists (who walk at speeds of 6.4 km/h) to visit all the tourist attractions within distances up to 1600m from the short-term rental where they are staying (Table 3). Even for other younger age-group pedestrians (< 65 years old) who walk at speeds of 4.8 km/h, the main tourist attraction can be accessed in a 15 min walk. Healthy individuals may be willing to walk considerably greater distances than the 600 meters threshold, which is considered standard in urban sustainable planning.

Table 3. Analysis of Lagos as a 15-Minute City

Facilities	Walking distances (m) between Short-term rentals and Facilities	Short-term rentals in the served area (%)
Tourist attractions	1600	100
	1200	90
	600	59
	300	34
	150	9

Source: Own Elaboration

It is assessed that most people, to reach tourist attractions, are willing to walk up to 1200m, which, for most able-bodied adults, can be accomplished within a 15-minute timespan. The results indicate that there is a trend towards urbanism of proximity considering the perspectives of young and healthy adults, and other older pedestrians (< 65 years old). In this case, the city of Lagos can be assessed as a 15-minute walk city.

However, gait speed of travel is a factor in accessibility. For older people (who walk at speeds of 1.2 km/h) and persons with significantly reduced mobility (who walk at speeds of 0.6 km/h), the known walkability standards (600m) are not applicable. They have less opportunities to visit the city by walking, from the short-term rentals to tourist attractions.

In fact, the concept of the 15-minute city has been criticized for being physically deterministic and taking a one-size-fits-all approach (Khavarian-Garmsir et al., 2023). In this urban planning approach, walking distance is considered from the perspective of the average person, when there is the temporal (daily and seasonal) variation in walking accessibility and the realities of vulnerable population groups (Willberg et al., 2023).

6. Conclusion

Around the world, in response to the global pandemic of COVID-19, strategic tourism policy measures have been implemented to limit close human contacts by restricting intensive use of public spaces and public transport, implementing social distancing through tactical urbanism techniques, leading to the prioritisation of pedestrians and cyclists in cities.

During this pandemic, the 15-minute city strategy has been associated with a wide range of benefits (Moreno et al., 2021; EIT Urban Mobility, 2022). Analysis of this proximity city can be developed considering travel impedance between origins and destinations by measuring travel distance or time along the street network.

Using the network analysis method of GIS, the present study analyzed the pedestrian accessibility to cultural touristic attractions in the city of Lagos mapping the areas served by these facilities. This paper presents the tourism perspective considering the visitors that stay in short-term rentals and have the opportunity of visiting the tourist attractions by walking. The issue of pedestrian access is very important in the location of tourism-related services.

The city of Lagos has an urban form and dimension that enables younger and healthy tourists to visit all the cultural tourist attractions. The results indicate that there is a trend towards an urbanism of proximity considering the perspectives of these young and healthy adults. However, gait speed of travel is a factor in accessibility. Older people and other persons with significantly reduced mobility have less opportunities to visit the city by walking, from the short-term rentals to tourist attractions.

According to the World Health Organization (2023) around 1.3 billion people experience significant disability, which is 16% of the world's population, or 1 in 6 of us. Considering the European Union, 5.9 % of the population are aged 80 years and older, in 2020. In consequence, there are many people who have significantly reduced mobility which requires the physical accessibility of pedestrian infrastructure (such as, sidewalks and crossings) and public transport, e. g. accessibility according to the universal and inclusive design. This aims to create safe, accessible and connected pedestrian networks that encourage and facilitate movement to tourist attractions.

The 15-Minute City has been considered a universal concept, a city for all, but some vulnerable people who have reduced mobility may be excluded. In this case, accessible public transportation can increase the opportunities for all people to reach the facilities and amenities. The 15-minute city concept offers a promising framework for sustainable urban living, but its success for individuals with reduced mobility hinges on universal and inclusive design. Ensuring physical accessibility and integrating collective transport options are crucial to making these urban environments truly inclusive and beneficial for everyone.

With the assumption that the transportation systems and pedestrian infrastructure are accessible for all, the 15-minute city concept matches an ideal geography where most people have close proximity to amenities and facilities, which are located within a travel distance of 15 minutes walking or cycling or by public transport.

This research study allowed a better perception of pedestrian accessibility to the facilities studied, considering the indicator "short distance". It has been realized that it is equally important to know the location and distribution in space of public facilities. It can influence the perception to develop relevant solutions of tactical urbanism around short-term rentals. The results facilitate identifying the tourism supply and priority areas for action to improve the built environment associated with pedestrian infrastructure.

These results provide an important contribution to sustainable and healthier tourism, promoting the pedestrian accessibility of cities as a tourist attraction factor that can generate confidence, health, sustainability and resilience. In the present research, travel impedance is presented as an important sustainable and inclusive tourism indicator for the cities. Proximity urbanism should be incorporated in tourism policies in order to contribute to the sustainability and social inclusion of tourist destinations.

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