THE 15-MINUTE CITY MODEL: THE CASE OF SICILY DURING AND AFTER COVID-19

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Resume
Travel restrictions due to COVID-19 initiated a radical rethink of the urban planning process, focussing on a concept initially proposed by Carlos Moreno in 2016; the "15-Minute City" model, aiming at the improvement of quality of life by creating or rearranging cities so that residents' needs can be reached within 15-minutes on foot or by bicycle or by public transit. In continuation to a research in 2020, this paper quantifies the attractiveness of the model to residents in nine regions of Sicily in 2022. Based on statistical analysis concerning the respondents' opinion, the model examined promotes walking as an anti-stress method and improves the overall health conditions at a community level. Therefore, policy makers can revalue the existing planning process and create a blueprint for a healthier and car-free lifestyle.

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1 Introduction

The concept of the safe travelling has radically changed due to the COVID-19 pandemic. Fear of contagion and restrictions, imposed by governments in an attempt to mitigate the disease, have contributed to a significant drop in travel frequency [1]. At the same time an increase in private vehicle use and non-motorized modes of transport has been observed [2]. The travel behaviours of citizens differ before and after the pandemic and they are highly affected by gender, car ownership, employment status, distance travelled, purpose of travelling and infection-related factors, such as use of face masks, cleanliness, social distance. Travel distances tend to become shorter and trips less frequent [2]. In areas with sufficient and proper pedestrian and bicycle infrastructure people might tend to use more sustainable modes of transport (walking, e-scooters, e-bikes).

Realising and quantifying these changes is crucial for optimisation of urban spaces. The current demand in terms of city planning shifts towards safer, sustainable and more inclusive cities, independent of private vehicles that increase social inequalities [3]. Many kinds of tools can be used in order to observe citizens' daily practices and mobility can definitely be considered as one, so to construct policies coherent with the emerging demands being made by populations using the city and its service [4]. One of the most promising concepts that satisfies the world's recent needs is the 15-minute city model [5-6].

The 15-minute city model derives from the "neighbourhood unity" concept, first developed in 1923 in a national architectural competition in Chicago, as a proposal to build new compact residential neighbourhoods. The proximity of services, public facilities and housing could create communities with a recognisable social and cultural identity on a local scale, counteracting the anonymity of large cities [7]. As an alternative, the concept of "city region" was developed, first explained in the Regional Plan of New York and its surroundings, published in 1929 [3].

The dissemination of planning tools, such as the SUMP (Sustainable Urban Mobility Plan), provides a set of medium- and long-term strategies by defining different components of individual actions and guidelines for all the parties involved. These urban and mobility planning tools:

- discourage high concentrations of settlement in the city centre through housing programmes in the suburban area, especially with low-density detached and semi-detached houses [8];
- promote the return of productive activities to the city (e.g. handicrafts, commercial activities) [9].
- advocate the construction of new, "compact" residential neighbourhoods, according to the dimensional and spatial criteria of the neighbourhood unit [10]

The new residential neighbourhoods, developed in the last twenty years outside the city centre, often lack services and require the use of transport to reach daily destinations. In order to create residential neighbourhoods, integrated with services, greenery, offices, it is necessary to rethink the location of certain public and collective functions.

Typically, these functions are located in the city centre, making the heart of the city a convenient place to live [10].

The first data recorded after the lockdown in Italy (end of May 2020) show a diversification in modal choice, where walking or cycling is preferred for short distances and private transport is favoured in other cases [11]. In fact, Italy was the first European country to register positive cases of COVID-19 from 8 March 2020 and to implement travel restrictions by adopting the national lockdown until mid-May 2020. Users preferred to travel alone, with individual means of transport, such as electric scooters and regular and pedal-assisted bicycles [12].

Mainly due to fear of contagion, the use of shared and public transport was abandoned. Considering this, local administrations are responding with the proposal of the "15-minute city", i.e. a city in which all the daily activities can be reached within fifteen minutes, either on foot or by bicycle [13].

The mobility concept associated with this urban planning model is characterised by walking and cycling. It is therefore emphasised that there is a different pyramid hierarchy between different modal choices that place the use of private vehicles at the base, compared to the pyramid hierarchy of the 15min city model that places walking at the base

The 15-minute city concept, aiming to maximise each user's time, was implemented before the pandemic in European and non-European cities such as Paris, Helsinki, Los Angeles and Singapore. In those cities, digital platforms or Mobility as a Service (MaaS) were developed by service operators to facilitate the user in multimodal choice [14].

In this sense, digital platforms have been developed to make end-to-end planning, booking and ticketing services interact for all the modes of transport, public or private, while reducing waiting times for users [15]. The 15-minute city concept can be successfully implemented if the presence of services (such as supermarkets, banks, offices) and public spaces for socialising (such as squares or playgrounds for children) are located near the workplace and residence.

This would allow citizens to carry out daily activities without wasting too much time on transport. At the same time, it would discourage the use of private vehicles in an attempt to tackle the problem of traffic congestion (especially during rush hours).

The increase in pedestrian accessibility to services aims to provide residents with a rational distribution of services that facilitates daily travel at a distance of between 200 and 800 meters, with respect to the location of the residences [16].

2 Literature review

The recent pandemic imposed many restrictions and showed that some cities were not ready for the generated impacts, especially in the health and mobility sectors. After the lockdown, it was advised to use single-user mobility options. In particular, in several European cities there has been an increase in the use of bicycles. Actions to improve mobility post COVID-19 include the implementation of new or temporary (pop-up) infrastructure, which in some cases has led to less spread of infections, for example in Germany [17] and Copenhagen [18].

Several parameters characterise 15-minute cities and can be the basis for highlighting the development benefits in different urban contexts worldwide.

In particular:

- easy accessibility
- optimisation of the location of services
- socio-economically equity
- reduction of the use of private vehicles
- strong pedestrianisation.

Most urban areas, built before the overwhelming proliferation of automobiles (1960s-1970s), had a 15-minute urban structure, so restoring the goal can be relatively easy. This will depend on the estimate of the damage produced by urban renewal, for example by the spread of limited traffic areas, the presence of motorways adjacent to the city and the population trend.

There are a lot of alternative and innovative transport modes that can be implemented in order to improve and make more efficient the existing (traditional) urban mobility system and thus, has started to be included within the policy agendas of many modern smart cities [19]. Development of the 15-minute city model allows for development of more infrastructure and pedestrian areas, making cities more liveable, walkable,

healthier, sustainable and economically productive [3]. Increased liveability is linked not only to the functional geometric improvement of streets but also to the better development of neighbourhoods, which also means that people are more likely to meet each other, increase sociality and build a sense of community.

These benefits are particularly relevant for the elderly, as creating spaces and opportunities for accidental social contact throughout the city can reduce the experiences of loneliness in old age [20]. This model provides an equitable socio-economic scenario - those without cars could easily access all their needs. Regarding inclusivity, developing neighbourhood planning can help address urban inequalities by considering those who cannot access urban services [21]. Among the Italian regions, Sicily was the most affected by the pandemic, where the public transport (i.e. trains and metro) is still very limited in terms of infrastructure and there is also a tendency to avoid the use [12], However, there are several parts of the existing infrastructure in which people can safely move on foot. To investigate the travelling habits in the pre-pandemic and the post-pandemic period an initial questionnaire was distributed to a specific sample, which consisted of Sicilian citizens, concerning the perception of walking not only as an alternative means of transport but as an anti-stress method, as well. In addition, the usefulness of implementing the 15-minute city model was assessed in order to make the short distance movement (<1km) more comfortable and quicker [22-23].

2.1 Development of city of proximity in Italy and in Sicily before and after COVID-19

"The "15-minute city" model, represents a city that offers to the citizens all the services they need on a daily basis by reaching the relevant destinations within fifteen minutes (in maximum) of walking from where they live. The evolution of cities and implementation of the 15-minute city model must comply with the technological and socio-economic evolution and the needs of the population [24].

Additionally, a study conducted by [25], highlights the characteristics of climate change and the ongoing pandemic, pointing out the main effects and consequences of these phenomena in cities and the vulnerabilities of the urban system. The dissemination of the 15-minute city model could create a climate-proof adaptive city in the post pandemic period.

The concept of "urban proximity", cannot be associated with the concept of physical proximity to the essential activities of daily life but must be about strengthening the social interactions that some places are more able to activate than others [26].

Over the years some cities, such as Milan, have already started efforts in order to adopt the concept of 15 minute-city model, without neglecting the goal of upgrading the neighbourhoods into attractive places of social aggregation for communities [27].

The above-mentioned research highlights the importance of correlation between the concept of spatial node to the node of local capacities and resources, recognizing the local community as the bearer, which is capable to guide and prefigure the process of regeneration in the post-COVID city.

Regarding Southern Italy, a study conducted by [28], identifies the urban characteristics in the city of Naples that define a 15-minute city, by emphasising to processes that urban, geomorphological, physical (regarding both spaces and routes, such as the geometry of pedestrian and bicycle networks), functional (distribution and location of services), socio-economical (of the population) and settlement characteristics, are taken into account.

Sicily is an island area, characterised by the presence of 3 metropolitan cities facing the sea namely Catania, Messina and Palermo. The rest of the cities can be classified as medium or small cities in terms of number of inhabitants, especially inland. Implementation of proximity city models would allow different contexts to be implemented in order to increase the sustainable urban mobility and help citizens to become more familiar with the daily routine under a 15-minute neighbourhood.

Moreover, based on research published in 2022 by [29], the outbreak of the COVID-19 pandemic had as affect to change the mobility of Polish resident in cities with a significant use of public transport and many residents started to prefer using their private vehicles. In addition, similar research has also shown that around 8% of citizens in Poland are using car-sharing. However, after the COVID-19 pandemic, more than 30% of the examined sample stop using it because of health concerns [30].

Another study, conducted in 2019 by [31], explores that urban sprawl has several negative impacts on the environment, economy and human health. Total of 110 municipalities in Sicily were considered. In addition, principal component analysis was adopted to create the Sicilian dispersion/compactness index and linear regression analysis was used to evaluate the association between the dispersion index and health outcomes.

It was shown that the public transportation has an inverse relationship with increasing sprawl while private transportation is directly related. Attention was also focused on the relationship between the evolution of urbanisation and its relationship with health outcomes, such as cardiovascular mortality.

The recent COVID-19 pandemic has disrupted travel choices for several months, as explained in the following section. Resulting in the desertification of some areas and the closure of businesses due to the rise of e-commerce and online activities [11-32].

Table 1 *Distribution of respondents based on gender (2020)*

Gender	Frequency	Relative Frequency (%)	Cumulative Relative Frequency (%)
Male	306	43.7	43.7
Female	394	56.3	100.0

Table 2 *Distribution of respondents based on age group (2020)*

Age	Frequency	Relative Frequency (%)	Cumulative Relative Frequency (%)
18-25	38	5.4	5.4
26-40	242	34.6	40.0
41-55	276	39.4	79.4
56-70	121	17.3	96.7
>70	23	3.3	100.0
Total	700	100	

2.2 The residents of Sicily during the COVID-19 era

A series of studies have been conducted from 2020 to 2022 to examine the travel behaviour of the Sicilian population. Different segments of population have been considered as well as psycho-social and displacement aspects, such as frequency of movement, preferable means of transport, vehicle ownership etc. The majority of relevant studies in Italy examine different regions of the north and does not focus on the whole country [33].

The region of Sicily has several problems related to the urban mobility, such as poor rail infrastructure in the central southern areas, the absence of highways connecting the westernmost part of the region and several critical issues related to multimodality (in different contexts switching from one mode of transport to another implies very long waiting times). Additionally, Sicily needs travelling connections by ship and airplanes, as all the islands do. The transportation problems, which were presented during the pandemic period, led a number of researchers to investigate regional and local travel dynamics.

A preliminary analysis was conducted on mobility choices [34], considering citizens' opinion regarding the mobility choices in two Italian cities, Palermo and Catania, before and during the pandemic. A series of studies conducted in the Sicilian context, revealed a propensity on the part of islanders to travel shorter distances, respecting social distance and other safety precautions during the COVID-19 therefore preferring to travel by foot or car. The Sicilian context was also the subject of investigations related to the use of public transportation during the different pandemic phases and the evaluation of sentiments that reduced the use of public transportation and travel in general during the various pandemic phases. Different segments of the population were investigated, emphasising on the modal choices of commuters such as workers and college students [35-36].

The present study stands as the first descriptive statistical analysis that instead investigated the propensity to consider walking as a stress-relieving antidote and also considered the view of the spread of proximity city models as useful to be able to popularise greater sustainable mobility and disseminate urban planning strategies that can lift contexts from the critical issues that emerged during the pandemic phase.

3 Descriptive statistics

3.1 Design of the survey

This research focuses on the qualitative evaluation of judgements of a randomly selected sample of users and made use of the CAWI (Computer Assisted Web Interviewing) methodology. The latter is a data collection methodology based on the completion of a web-based questionnaire provided through a link, panel or website. In particular, the study was conducted through the drafting of a closed form questionnaire, distributed online through the Google platform. The sample of users examined refers to a section of members of a social Facebook group of Sicilian inhabitants who generally walk daily for both work and leisure. The sample investigated was composed of 700 users and it was disseminated from February to March 2020 and repeated in March 2022 in order to compare the same date from two different periods.

3.2 Data analysis through the use of descriptive statistics

This study involves a questionnaire distributed in nine cities of Sicily, Italy and consists of two parts. In the first part, the basic socio-demographic data were collected such as gender, age and level of studies. As shown in Tables 1 and 2, 43.7 % of the respondents were male, almost 40 % of them were 41-55 years old. and 40 % of them were 18-40 years old.

Table 3 *Distribution of respondents based on groups of cities in 2020*

Groups of cities	Frequency	Relative Frequency (%)	Cumulative Relative Frequency (%)
metropolitan	157	22.4	22.4
medium	330	47.1	69.6
small	213	30.4	100.0
Total	700	100	

Table 4 *Distribution of respondents based on groups of cities in 2022*

Groups of cities	Frequency	Relative Frequency (%)	Cumulative Relative Frequency (%)
metropolitan	130	18.6	18.6
medium	309	44.1	62.7
small	261	37.3	100.0
Total	700	100	

Table 5 *Distribution of respondents based on car driving*

Car ownership	Relative Frequency 2020	Relative Frequency 2022
I have and I drive	90.7	94.7
I have and I don't use it	6.4	3.9
I do not have	2.9	1.4
Total	100	100

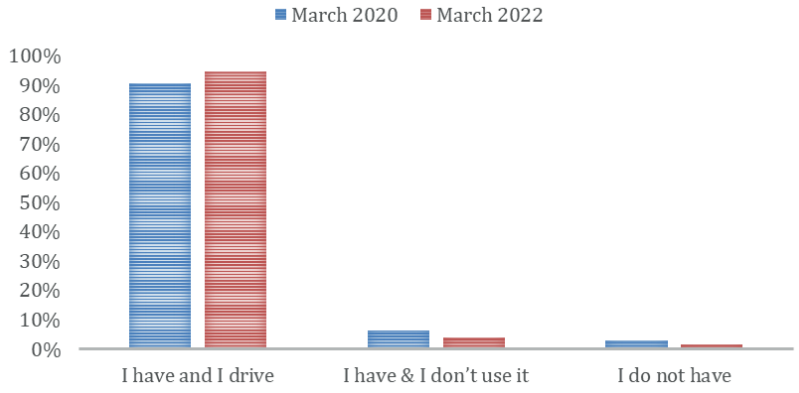

Figure 1 *Car ownership and use (period March 2020-March 2022)*

It is also important to mention that the percentages of gender and age groups for the respondents of the questionnaire in 2022 are very close and almost the same as the above of 2020.

Additionally, the sample of the respondents is divided in three groups based on the population of the nine cities of the research (Tables 3 and 4). The first group consists of small towns with population less than 60.000 (Agrigento, Enna), the second group includes cities with population more than 60.000 habitants and less than 300.000 (Syracuse, Ragusa, Trapani, Caltanissetta) and the third group consists of cities (metropolitan areas) with population ranging from 300.000 to 700.000 (Catania, Palermo, Messina). Almost half of the sample, 47.1% in 2020 and 44.1% in2020), live in medium cities and more than three of ten of the respondents are habitants of Agrigento or Emma (small cities).

In the second part of the questionnaire, the respondents were asked if they possess a car. Based on the results of 2020 and 2020 presented in Table 4, the vast majority of the sample (more than 90%) owns and uses a car.

As shown in Table 4, there was a further increase in use of vehicles in March 2022. This could be linked with the fact that there was a reduction in the frequency of use of the public transport. Additionally, based on Table 5 and as shown in Figure 1, the majority of the respondents, in both time periods (2020 and 2022) possess and drive their own car.

Moreover, citizens were asked if they consider walking an anti-stress method. Figure 2 shows that 90% of the respondents (in 2020 and in 2022) agree or strongly agree with the statement. The percentage of the sample that disagree or strongly disagree with this fact is extremely low and equal to 2.3% in 2020 and less than 1% in 2022.

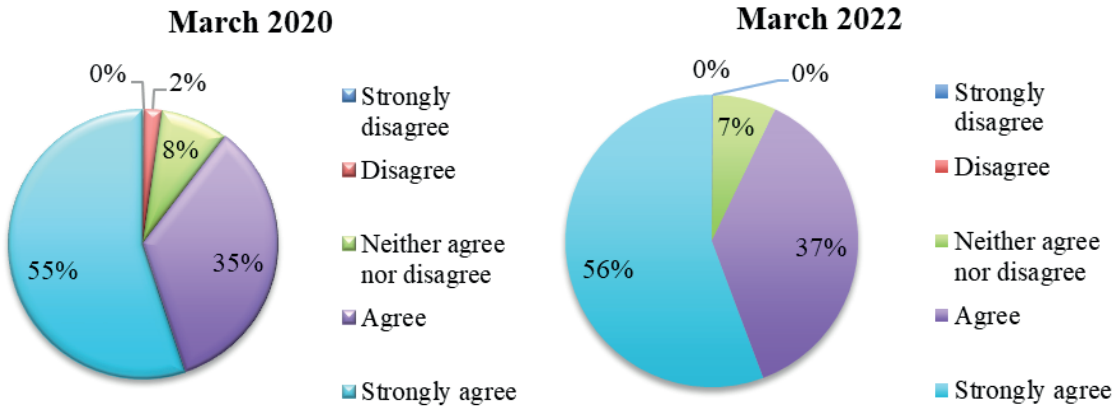

Figure 2 *Walking like antistress concept trend (period March 2020-March 2022)*

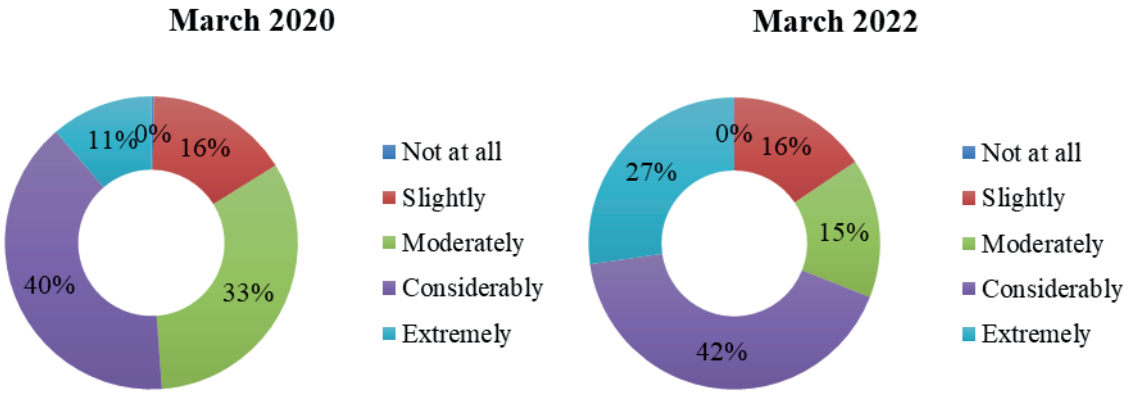

Figure 3 *Usefulness of the 15-minute city model during the monitored periods (March 2020-March 2022)*

It is critical to understand that despite the fact that more than 90 % of the respondents use to drive a car, the same percentage of the sample characterize walking as an anti-stress method.

Finally, they were asked how useful they think it would be to see their cities under the 15-minute city model. More than half of the sample in both examined periods believes that the 15-minute city model would be useful in their city. However, 32.7 % of them neither agree or disagree like described on Figure 3 below.

A series of questions pertaining to the third section of the survey emphasises the need to include 8 services as priorities in the planning of a neighbourhood city.

Some of these services are related to health and education (such as hospitals and schools and libraries), others are related to a socioeconomical aspect (such as local markets, stores) and other to community centres and green spaces; in particular importance was also given to the investigation of improving the road network. In particular, as health services are defined those primary services connected with health care or support.

Then, there are the social centres, which must be open, above all, to young people and families and be the scene of new collaborations with other realities and subjects in the area. Neighbourhood libraries and surrounding areas, understood as places to be enhanced by virtue of their cultural, aggregative and educational role, as well as social presidium in territories that are often peripheral and crossed by social fragility. Oratories, identifiable in places of community gathering, capable of playing an essential role in building cultural exchange, including the interethnic world. Neighbourhood markets, which offer forms of meeting and presiding over the territory with spin-offs in terms of social cohesion in daily life. Schools, understood as places where gathering spaces provide stimuli for the construction and transmission of knowledge. Green spaces, which for neighbourhood residents, represent the spaces for meeting and socialising and which should be more open, accessible and attractive. The road system, which, in addition to being the subject of discussion on mobility policies, is the public space where the needs of the weakest (of the homeless, immigrants ...) are manifested and it is there that it is easiest to intercept the needs of fragile individuals. Commercial activities, which from large shopping centres in the suburbs prospect (in some cities have already been realised) types of businesses that straddle the line between the large supermarket and the post-war "grocery" store.

The research investigated which user choice trends,

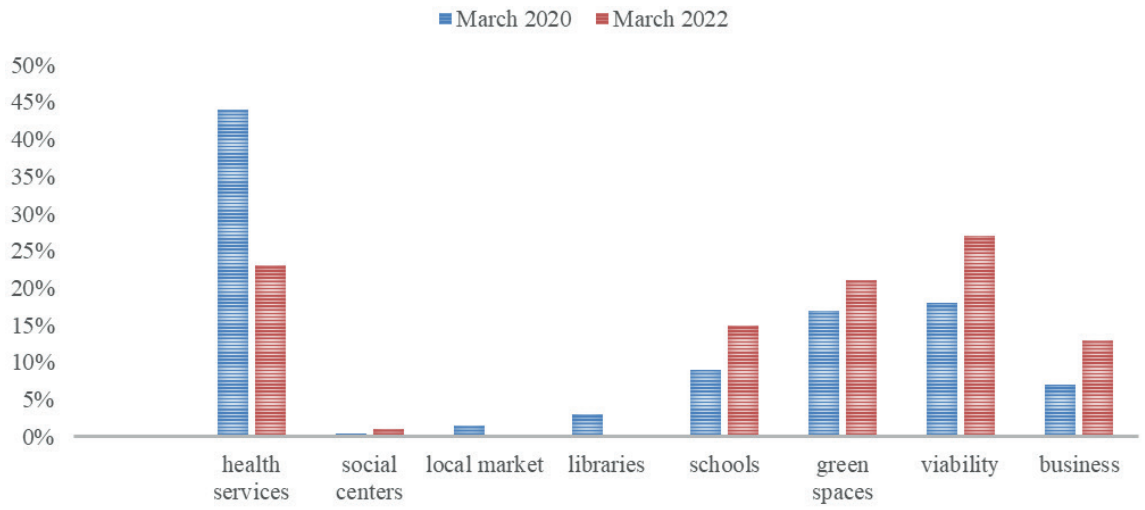

Figure 4 *Comparison of the main services necessary for the definition of a proximity city (period March 2020-March 2022)*

could define priority among those in light of the spread of the virus and strategies to mitigate the spread. Therefore, Figure 4 shows the comparison between years 2020 and 2022.

4 Discussion

The recent pandemic has underlined the importance of respecting the social distancing and encouraging short journeys by making everything easily accessible. The future that cities are preparing for in the post-pandemic phase is linked to a revision of city models, introducing in metropolises, such as London, Paris, Milan or Madrid, the possibility of guaranteeing their inhabitants a sustainable standard of living by ensuring that citizens can travel as little as possible to obtain goods and services. Metropolises have thus begun to rethink themselves, imagining a future similar to that of cities such as Barcelona, famous for its self-sufficient neighbourhoods called "superblocks". The most recent example is Paris and it is a model that Milan now seems to want to take inspiration from. Future surveys can be conducted taking into account the updated transportation habits of citizens after the pandemic period and focus on specific modifications for the existing urban mobility systems in the European Union, so as to create new alternative models of transport such as the 15-minute city model. Implementing a 15-minute city model means guaranteeing citizens all the primary services within a quarter of an hour on foot or by bicycle. To achieve this, it is necessary to lengthen the metro route, reserve a portion of social housing for social housing and work on the spread of IoT technologies, as well as promoting the concept of smart cities. In order to implement useful actions for the population, it is necessary to introduce the concept of participatory planning by promoting the active participation of population in urban planning and mobility choices, participating in surveys/interviews and disseminating awareness campaigns. This can bring out the criticalities of each city at different levels of society and allow the better choice of actions to be taken.

5 Conclusions

The concept of proximity, which is the basis of the city's function, was challenged in the last century when the decision makers (re)thought cities around an idea of efficiency placed on specialization and economy of scale. In deference to efficiency, specialized portions of cities were built (industrial zones, business centres, university citadels, sports centres, residential-dormitory districts etc.). In each of those zones, specific functions of activity and services were concentrated.

The data analysed showed an increase in the use of the private vehicle over the two years monitored, as well as a slight increase in the propensity to implement proximity city strategies and models. In addition, the improvement of services, both related to health, as well as related to the road system and the creation and maintenance of green spaces, will have to be taken into account by local administrators to improve the urban liveability starting from the neighbourhoods. Based on the research results from both time periods (2020, 2022), the 15-minute city model can be very useful for Sicilian residents with its significance to be increased a lot after the pandemic experience.

Useful references are the best practices, where governance has initiated particularly relevant social and urban innovation experiences: think of Paris, Barcelona, Milan. The 15-minute city model is a model of urban development that does not follow the common trends in urban planning. It outlines a scenario where everyone has access to all the services needed at a maximum distance of 15 minutes on foot or by bicycle. A city of this type re-evaluates the concept of the neighbourhood,

which becomes a complete cell of urban life. This concept aims to optimise space, conveying a reflection on the resources available and how they are used. It promotes the presence of green areas to cool down in summer and replace busy streets.

This city model allows for implementation of the majority of the restrictions and strategies developed for restarting activities in urban settings post COVID-19, demonstrating and reducing displacement

The spread of online education and teleworking on a larger scale, the search for services as close as possible to home, the temporary reduction in urban traffic flows and rediscovery of the urban dimension of the neighbourhood, inevitably raise the question of whether an alternative to the frenetic rhythms, traffic and long distances is actually feasible in the near future.

The spread of this good planning practice must therefore ensure that those who live in the centre and those who live in the suburbs have access to all the essential services nearby. The city thus maintains its role as a social, economic and cultural reference point and every citizen can enjoy every advantage of city life without too much difficulty.

Author contribution

Research planning, data analysis and final draft prepared by Tiziana Campisi and Socrates Basbas, initial draft, analysis was done by Thomas Papas and Mirto Trouva, data collection was done by Tiziana Campisi and Giovanni Tesoriere and paper writing modification was done by Tiziana Campisi and Giovanni Tesoriere.

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Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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