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*Article*

# Modeling the Health Benefits of Superblocks across the City of Los Angeles

**Kenan Li** [1,*] **and John P. Wilson** [2,3,4,5,6,7,*]

1 Department of Epidemiology and Biostatistics, Saint Louis University, Saint Louis, MO 63103, USA
2 Spatial Sciences Institute, University of Southern California, Los Angeles, CA 90089, USA
3 Department of Population and Public Health Sciences, University of Southern California, Los Angeles, CA 90032, USA
4 Department of Civil and Environmental Engineering, University of Southern California, Los Angeles, CA 90089, USA
5 Department of Computer Science, University of Southern California, Los Angeles, CA 90089, USA
6 Department of Sociology, University of Southern California, Los Angeles, CA 90089, USA
7 School of Architecture, University of Southern California, Los Angeles, CA 90089, USA
* Correspondence: kenan.li@slu.edu (K.L.); jpwilson@usc.edu (J.P.W.)

**Abstract:** Superblocks can help to transform urban areas into pedestrian-centric neighborhoods. First launched in Barcelona, Spain, they are expected to reduce harmful environmental exposures, increase green space access and thereby provide substantial health benefits. However, few studies have examined the practicality and likely benefits of implementing Superblocks in other metropolitan areas. We developed a methodological framework to build a generalizable City of Los Angeles (LA) Superblocks Model and evaluate the predicted health benefits that would follow such an intervention. We derived and used five rules to guide the choice of arterial streets and candidate blocks and the choice of major bounding streets that could facilitate mobility across the metropolitan area. We next used the BenMap-CE model to perform a quantitative assessment of the health and economic benefits that would accompany five scenarios that would transform 5–50% of the residential areas in the City of LA to Superblocks. We found that the creation of superblocks resulted in significant reductions in hospital admissions and significant economic savings. The benefits were strongest when 5–10% of residential areas were transformed, but rapidly decreased as the threshold reached 30%. These results will help stakeholders determine the optimal balance between reduced car traffic and improved health outcomes. Moreover, we illustrated how to develop a Superblocks model for a highly versatile and populated metropolitan area like the City of LA and how the model can be used to assess the potential health benefits and benchmark the relationship between the scale of the Superblock implementation and the accompanying health benefits moving forward.

**Keywords:** Superblocks; Los Angeles; air pollution mitigation; synthesized system; BenMap-CE; EnviroAtlas



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## 1. Introduction

The United Nations reported in 2014 that urban areas will support an additional 2.5 billion population due to population growth and continued migration from rural areas over the next 40 years [1]. Moreover, this same report predicted that continuing urbanization would lead to 70% of the world's population living in cities by 2050. This sustained urban growth has led to many overpopulation issues that threaten residents' quality of life and the sustainability of urban development, such as traffic congestion, housing shortages, poor infrastructure development, inadequate public services, energy deficiencies and environmental pollution [2,3]. Additionally, at higher levels, rapid and excessive urbanization has more often than not exacerbated urban poverty and rural–urban inequities [4]. Poverty inequities carry statistical significance in many population mortality equations and as such will exacerbate population health inequities [5].

One sustainable strategy for countering the aforementioned urbanization issues and regenerating our cites is the Superblocks model. The Superblocks term was introduced into the urban planning field in 2020 and used to represent one large block that combined many smaller blocks created by older street grid systems [6,7]. This model was later adopted by the Barcelona City Council in collaboration with the Urban Ecology Agency to foster sustainable mobility in the city [8]. In the Barcelona superblock model, Superblocks are territorial units that use a variety of interventions to reclaim space for the people, reduce motorized transport, provide urban greening to mitigate the effects of climate change and ultimately improve the quality of life of residents [9]. A recent study estimated the health impacts of this innovative urban and transport planning model in Barcelona and projected that 667 premature deaths (95% CI: 235–1098) could be prevented annually if 503 Superblocks were established in the city (Mueller et al. 2020). The largest number of lives saved was attributed to reductions in NO2 levels (291, 95% PI: 0–838), followed by road traffic noise (163, 95% CI: 83–246), heat (117, 95% CI: 101–137) and green space development (60, 95% CI: 0–119). This study also comprehensively translated the estimated annually prevented premature deaths into a substantial economic impact of 1.7 billion EUR and average gains in life expectancy of almost 200 days due to reductions in harmful environmental exposures. The health impact assessment incorporated the best epidemiological affirmed evidence, shed light on the population health benefits that would accompany real-life Superblock interventions and laid out the foundation of scaling up the Superblock interventions to other cities, where similar health benefits can be expected.

The City of LA is the second-largest city in the United States and well known for its sprawling metropolitan area, traffic congestion and traffic related air pollution (TRAP) [10]. In addition, the presence of two major seaports and the associated goods movement infrastructure creates additional emissions from diesel vehicles [11–13]. To counter the adverse health impacts of air pollution, the City of LA has explored the use of transit malls, people-first streets and superblocks to reduce gasoline-powered automobiles and diesel freight vehicles passing through neighborhoods, TRAP, noise and the urban heat island effect [14]. Some preliminary modeling by Fitzgerald et al. [15] to predict the health benefits of these interventions has been undertaken, but their work is limited because their proposed Zero Emission Areas (ZEAs) were few in number and modest in terms of areal extent. In this study, we aim to build a more powerful series of arguments for implementing superblocks on a larger scale across the City of LA.

The superblock method has several advantages over conventional urban planning approaches. Firstly, it reduces the amount of traffic and promotes sustainable transportation options, such as walking, biking and public transportation. This can lead to improved air quality, reduced carbon emissions and increased physical activity. Secondly, superblocks can increase the amount of green space and promote more livable, healthy and walkable neighborhoods. This can result in improved public health outcomes and increased social interaction. Additionally, superblocks can support local economies by reducing the amount of car traffic and creating more attractive and pedestrian-friendly commercial districts. Finally, superblocks can be implemented gradually and incrementally, allowing for a flexible and adaptable approach to urban planning that can respond to changing needs and priorities over time.

However, implementing superblocks in urban planning can have both advantages and disadvantages. On the positive side, superblocks can improve public health by reducing traffic and air pollution, encourage active transportation and enhance quality of life. Additionally, superblocks can also lower carbon emissions and create more livable neighborhoods. However, implementing superblocks can also result in disruption to car traffic, economic impacts, implementation challenges and a lack of data on the long-term effects. It is important to carefully weigh these factors when considering the implementation of superblocks in urban planning. Balancing the advantages and disadvantages of implementing superblocks requires careful planning and stakeholder engagement. To achieve this balance, urban planners and policymakers should conduct thorough research, engage with stakeholders to understand their needs, consider alternative solutions and develop a comprehensive implementation plan. By taking a holistic and proactive approach, it may be possible to create more livable and sustainable communities while addressing potential challenges. Quantitative research that considers scenarios of transforming various percentages of residential areas would greatly enhance stakeholders' ability to evaluate the pros and cons of implementing Superblocks. In this study, we use BenMap-CE (*Environmental Benefits Mapping and Analysis Program-Community Edition*) [16] and i-Tree tools [17], along with several datasets from EnviroAtlas [18], to model the health benefits that would accrue from transforming 5, 10, 20, 30 and 50% of the residential neighborhoods in the City of LA into Superblocks. BenMap-CE provides a well-documented suite of tools to examine the health impacts of monitored air quality changes, the health burden of recent and future modeled air quality and transportation, and climate-related impacts. Based on the expected changes in urban and transport planning related exposures calculated by the i-Tree program, we used BenMAP-CE with remotely sensed satellite imagery and local air quality monitoring data to: (1) estimate the reductions in four types of air pollutants (listed in Table 1) in the City of LA; and (2) model the health effects of reductions in those exposures by Superblock interventions and the accompanying economic impacts. The residential neighborhoods used in this work mirrored the slow streets and alfresco dining initiatives introduced by the City of LA Department of Transportation during the COVID-19 pandemic because these locations had already implemented some of the changes that would be likely to follow the establishment of Superblocks.

**Table 1.** Air pollutant reduction, health benefit and economic benefit indicators.

| **Air Pollutant Reduction** | **Acronym** | **Unit** |
|---|---|---|
| Sulfur dioxide removed annually by tree cover | SO2AQYr | kg/yr |
| Nitrogen dioxide removed annually by tree cover | NO2AQYr | kg/yr |
| Ozone removed annually by tree cover | O3AQYr | kg/yr |
| Particulate matter [PM2.5] removed annually by tree cover | PM25AQYr | kg/yr |
| **Health Benefits** | **Acronym** | **Unit** |
| Hospital admissions avoided due to sulfur dioxide removed by tree cover | SO2HosI | cases/yr |
| Hospital admissions avoided due to nitrogen dioxide removed by tree cover | NO2HosI | cases/yr |
| Hospital admissions avoided due to ozone removed by tree cover | O3HosI | cases/yr |
| Hospital admissions avoided due to particular matter (PM2.5) removed by tree cover | PM25HosI | cases/yr |
| **Economic Benefits** | **Acronym** | **Unit** |
| Value of hospital admissions avoided due to sulfur dioxide removed by tree cover | SO2HosV | $/yr |
| Value of hospital admissions avoided due to nitrogen dioxide removed by tree cover | NO2HosV | $/yr |
| Value of hospital admissions avoided due to ozone removed by tree cover | O3HosV | $/yr |
| Value of hospital admissions avoided due to particular matter (PM2.5) removed by tree cover | PM25HosV | $/yr |

## 2. Materials and Methods

### *2.1. The LA Superblocks Model*

The first two Barcelona Superblocks were built to remove cars and provide space to pedestrians in the El Born (1994) and in the Gràcia (2005) neighborhoods, respectively. The recent Barcelona Superblocks plans initially aimed to merge clusters of nine "old" blocks defined by the 19th century urban planner Ildefons Cerda in a 3 × 3 gridded pattern, but in practice the Superblocks include larger areas to simultaneously support regional mobility and local traffic reduction [19]. The current plan envisages 503 Superblocks, stretching across the City of Barcelona, with varying sizes and layouts in addition to the square blocks measuring 400 m per side in the center of the city. For a highly populated and diverse city like LA, we chose Superblocks to both fit the City of LA's ongoing initiatives to promote safe and accessible streets, along with 3 × 3 blocks, and more importantly the city's goals and plans for physical development, as laid out in the City of LA's Mobility Plan 2035 and the City of LA's General Plan.

Superblocks aim to give preference to pedestrian traffic in the interior public spaces and limit motorized traffic to residential cars, emergency service vehicles, delivery vehicles and other occasional vehicles in special circumstances. The normal motorized traffic circulates around the perimeters of the Superblocks. In order to assure that none of the proposed Superblocks would interfere with the city of LA's arterial roads, we defined two rules. The first was that Superblocks cannot contain any arterial streets designated by the city's General Plan Circulation System and the second rule specified that the Superblocks must be surrounded by arterial streets to facilitate traffic circulation and minimize traffic congestion. The streets classified as Boulevard I, II and Avenue I, II, III by the updated Street Standard Plan S-470 of the LA Bureau of Engineering were considered as arterial roads.

The Barcelona Superblocks model was invented under the city of Barcelona's Action Plan, by which the street blocks to be included were chosen through a participatory process with the neighborhood associations and residents. The LA's Mobility Plan 2035, as one important element of the City's General Plan, laid out a policy foundation for achieving a transportation system that balances the needs of all road users and introduced an Action Plan that included a coordinated series of actions the city hopes to take over the long-term to accommodate all road users. Five types of road networks were outlined in this Action Plan: (1) a Transit Enhanced Network to support transit; (2) a Neighborhood Enhanced Network to provide a calm and safe environment for walking, biking and circulation of slower moving modes; (3) a Bicycle Enhanced Network to support bicycle movements; (4) a Vehicle Enhanced Network to support vehicle movement; and (5) Pedestrian Enhanced Districts to improve the walkability of streets that serve schools, parks, community gathering places and major employment locations.

Finding ways to support all these five goals is difficult, because upon further investigation we found that substantial parts of the Neighborhood Enhanced Network (21.9%) and most of the Bicycle Enhanced Network (90.3%) and Pedestrian Enhanced Districts (94.7%) are associated with arterial roads or the sidewalks of arterial roads in the city's General Plan Circulation System. Given our decision to use the arterial roads as the perimeters of the Superblocks, we decided to focus on the parts of those networks and districts not designated as arterial roads or their sidewalks when choosing Superblock candidates. Two further rules were implemented as follows.

The first (Rule III) was that the Superblocks could not contain any road segments in the Vehicle Enhanced Network and the second (Rule IV) was to rank the conversion abilities of the Superblocks by the total length of road segments they contained in the Neighborhood Enhanced Network, Bicycle Enhanced Network and Pedestrian Enhanced Districts (excluding the arterial roads). Finally, we added a fifth rule, by which the Superblocks must cover >100,000 $ft^2$, which serves as a relatively common city block size for major international cities [20] and must contain more than 12 road segments of any road types, which geometrically is the minimum number of road segments to encapsulate nine gridded interior blocks.

### 2.2. Intermediate Effects

A series of intermediate effects have been used to connect the Superblocks to health outcomes. For example, the superblocks in the City of Barcelona were expected to improve the habitability of public spaces, advance sustainable mobility, increase urban green spaces and promote residents' participation. All of these intermediate effects will help to promote health outcomes [21]. Previous research summarized the neighborhood-level intermediate effects in terms of air and noise pollution reductions, traffic safety improvements, more walkability options, new and improved recreational spaces, rising house values, better sense of community and security and stronger social networks [22].

Specifically, Superblocks aim to limit vehicle mobility, increase urban green spaces and decrease air pollution. There is a growing body of evidence that has revealed statistically significant associations between air pollution and many respiratory diseases including asthma and allergies (e.g., Ref. [23]. Meanwhile, limiting vehicle mobility and increasing urban green space also indirectly promote traffic safety, walkability and active recreation. These outcomes not only reduce risk of traffic injury but also promote physical and social well-being [24].

In this study, we chose increasing urban green space (indicated by tree canopy) as the Superblock intervention and air pollution reduction (indicated by $NO_2$, $SO_2$, $PM_{2.5}$ and $O_3$) as the intermediate effects to model the health and economic benefits (indicated by the hospital admissions that would be avoided) of the LA Superblocks Model. Table 1 lists all the indicators.

### 2.3. Health and Economic Outcome Evaluations

The estimation of tree cover changes and their health and economic benefits in Superblocks followed the procedures of EnviroAtlas ( [18] in estimating the tree cover changes in census block groups. The total amount of tree cover ($m^2$) in Superblocks were derived from a high-resolution community land cover map offered by EnviroAtlas. The "i-Tree" pollution removal program [25] was then run for each Superblock, assuming a leaf area index value of 4.9 (the same value as the one EnviroAtlas used to run the "i-Tree" program for census block groups) and utilizing the closest hourly meteorological and pollution data. Hourly estimates of pollution removal by trees were combined with atmospheric data to estimate annual reductions for the four pollutants listed in Table 1 [26].

The hospital admissions avoided due to the expanded tree cover were calculated using BenMAP-CE. This model estimates health impacts and related costs or savings based on the local population and changes in pollutant concentrations. We applied the county-level multipliers of health impact per person per pollutant change calculated by EnviroAtlas to our Superblocks and then incorporated the changes in pollutant concentrations calculated with the "i-Tree" program and U.S. Census Bureau age distribution data reallocated from census block groups to Superblocks in running the Ben-Map-CE model. The willingness to pay estimates was derived from health impact functions detailed in epidemiological studies described in the BenMAP-CE Manual and accompanying appendices [27].

### 2.4. Resilience to COVID-19 Impacts

In May 2020, the City of LA started offering two programs to mitigate the unprecedented COVID-19 pandemic crisis: (1) Alfresco dining to support outdoor dining opportunities for restaurants hit hard by the COVID-19 in coordination with the LA County Department of Public Health; and (2) a slow streets program to create additional opportunities for people to stay physically active while socially distant by reducing speeds on neighborhood streets. These initiatives launched by the City of LA offered good guidance in the choice of large-scale target superblock neighborhoods and great opportunities for testing the implementation of the LA Superblocks Model. In this study, we compared the slow streets closures and alfresco dining locations provided by the City of LA Department of Transportation with the Superblocks locations to verify the conversion ability of the locations.

## 3. Results

### 3.1. Proposed Superblocks in LA

After applying the first four rules of the LA Superblocks Model, we generated 950 Superblock candidates. These candidates are surrounded by arterial roads and did not contain any arterial roads or road segments that are parts of the City of LA's Vehicle Enhanced Network. Those attributes are crucial, because they assure compliance with the goals of improving the habitability of public space, advancing sustainable mobility and increasing urban green spaces. However, we found that a subset of the candidates were either very small or did not contain sufficient interior road segments. Thus, we applied the fifth and final rule to generate our final list of 597 Superblocks. Figure 1 shows all 597 Superblocks (blue polygons) and those excluded by their size or the number of interior road segments (white polygons). The map and inset show that many of the Superblock candidates in or near Downtown Los Angeles (DTLA) were excluded, since they are actually individual census blocks and do not contain any road segments within them. There are also some Superblock candidates in the San Fernando Valley that were excluded even though they are large in size, because they contained recreational areas with large water bodies that were not suitable for Superblocks.

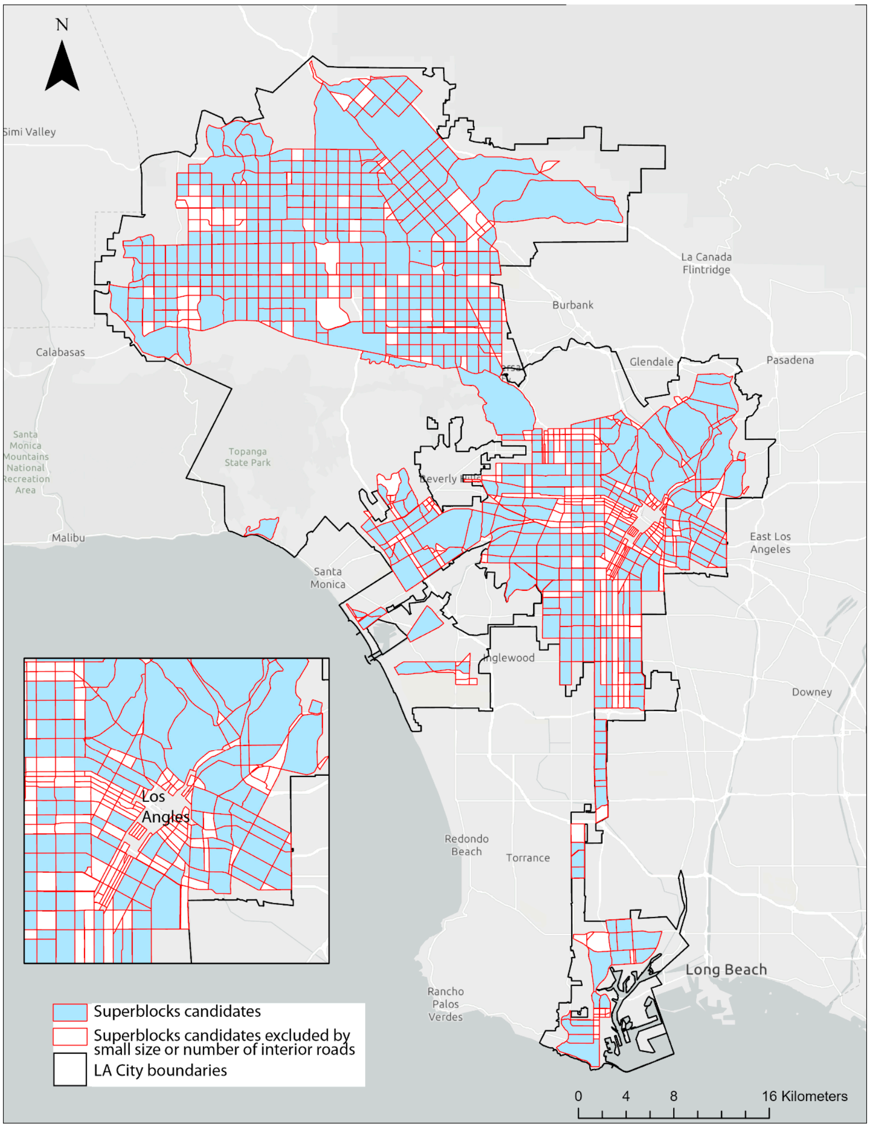


**Figure 1.** Superblocks generated by Rules I–V (blue) and Superblock candidates generated by Rules I–IV but excluded by Rule V (white).

### *3.2. The Scenarios Used to Transform Residential Areas*

The Superblocks generated in Section 3.1 highlight the most feasible locations for implementing Superblock interventions, but they may not constitute residential areas. Since the implementation of Superblocks is highly linked with the residents' participation and co-responsibility and the estimation of the health and economic benefits is also highly connected with residential areas, it is crucial for us to understand the residential areas in the proposed Superblocks. We obtained the boundaries and use codes of approximately 2.4 million land parcels in LA County from the LA County Assessor's Data Portal. We then extracted those located in the City of LA with Residential use codes to generate the high-resolution City of LA residential area map. We first ranked the 597 Superblocks by their conversion ability defined in Rules I–V. The 597 Superblocks covered approximately 54.8% of the residential areas in the City of LA. We next chose appropriate conversion thresholds to develop five scenarios for transforming approximately 5%, 10%, 20%, 30% and 50% of the City of LA's residential neighborhoods into Superblocks. Specifically, we chose: (1) 2550 m as the conversion threshold (i.e., total length of contained road segments in the Neighborhood Enhanced Network, Bicycle Enhanced Network and Pedestrian Enhanced Districts) and selected 45 Superblocks that covered 4.99% of the City of LA's residential areas for Scenario 1; (2) 1625 m as the conversion threshold and selected 94 Superblocks (including the 45 Superblocks from Scenario 1) that covered 10.04% of the City of LA's residential areas for Scenario 2; (3) 1010 m as the conversion threshold and selected 169 Superblocks (including the 94 Superblocks from Scenario 2) that covered 20.07% of the City of LA's residential areas for Scenario 3; (4) 745 m as the conversion threshold and selected 302 Superblocks (including the 169 Superblocks from Scenario 3) that covered 30.07% of the City of LA's residential areas for Scenario 4; (5) 115 m as the conversion threshold and selected 530 Superblocks (including the 302 Superblocks from Scenario 4) that covered 50.97% of the City of LA's residential areas for Scenario 5. Figure 2 shows the Superblocks included in each scenario.

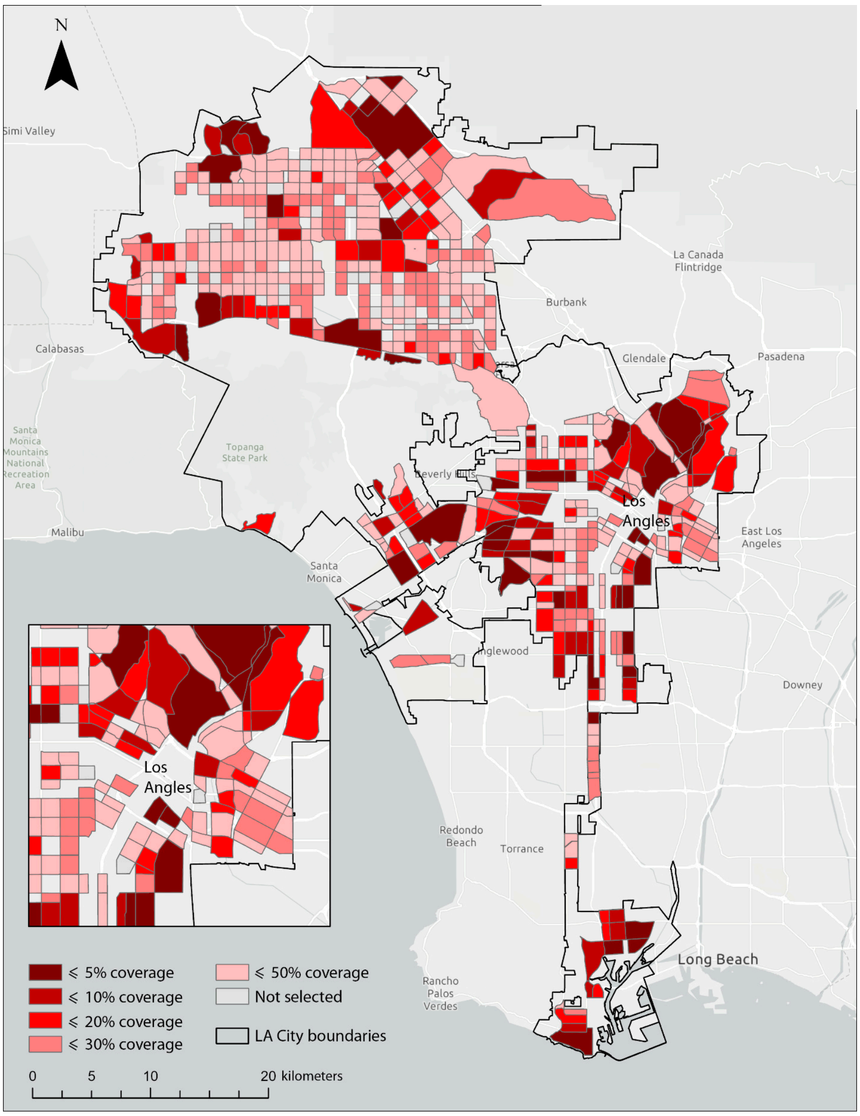


**Figure 2.** Superblocks included in each of the five transformation scenarios.

### *3.3. Estimates of Air Pollutant Reductions*

The reductions of four types of air pollutants (i.e., $SO_2$, $NO_2$, $PM_{2.5}$ and $O_3$) at the Superblocks level were estimated in this study using the i-Tree tools. We followed the procedures of EnviroAtlas in estimating the reductions of the four air pollutants by tree cover and assumed that the Superblock interventions would double the tree cover of the designated areas and that other social characteristics would not change. We found that even though the four air pollutants have various ranges of projected reductions (e.g., $O_3$ reduction has the largest range from 0 to 30,195.61 kg/yr and $PM_{2.5}$ reduction has the lowest range from 0 to 495.45 kg/yr), the spatial distributions of the reduction of the four pollutants were highly correlated, as shown in Figure 3.

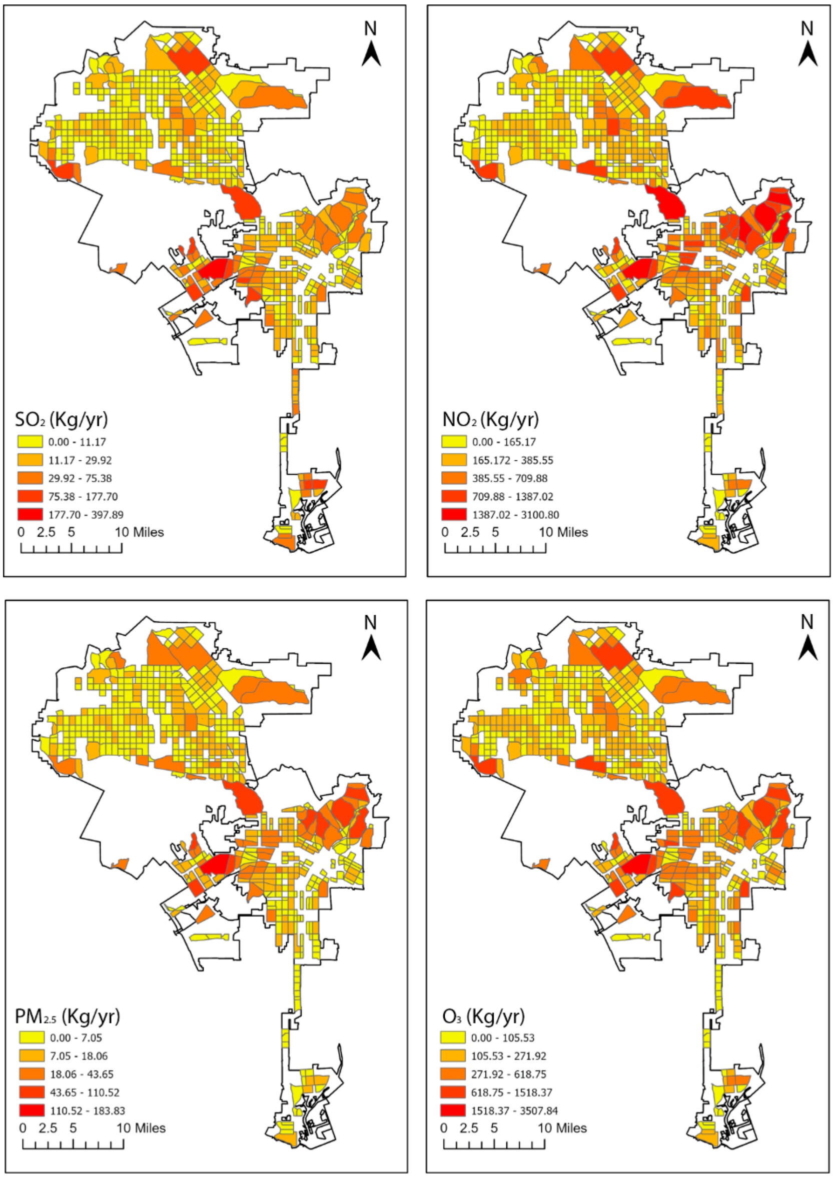


**Figure 3.** Annual air pollutant reductions from increasing tree cover estimated by i-Tree tools.

### *3.4. Estimates of Health and Economic Benefits*

We built and ran the BenMap-CE model as described in Section 2.3 and calculated the avoided hospital administrations due to the projected air pollutant reductions. We then extended the BenMap-CE model to translate the health benefits indicated by the reduction of hospital admissions to economic values in dollars. After that, we summarized the annual amounts saved from avoided hospital admissions for each air pollutant under the five residential area transformation scenarios. Figure 4 shows the spatial distributions of the annual hospital admissions avoided due to the air pollutant reductions estimated by the BenMap-CE model and Figure 5 shows the annual ln($) saved from hospital admissions avoided due to the air pollutant reductions under the five Superblocks scenarios. We found that the economic benefits indicated by annual values saved from hospital admissions increased the fastest when 5–10% of the residential areas were transformed and the rate gradually decreased afterwards and became less perceptible when 30–50% of the residential areas were transformed.

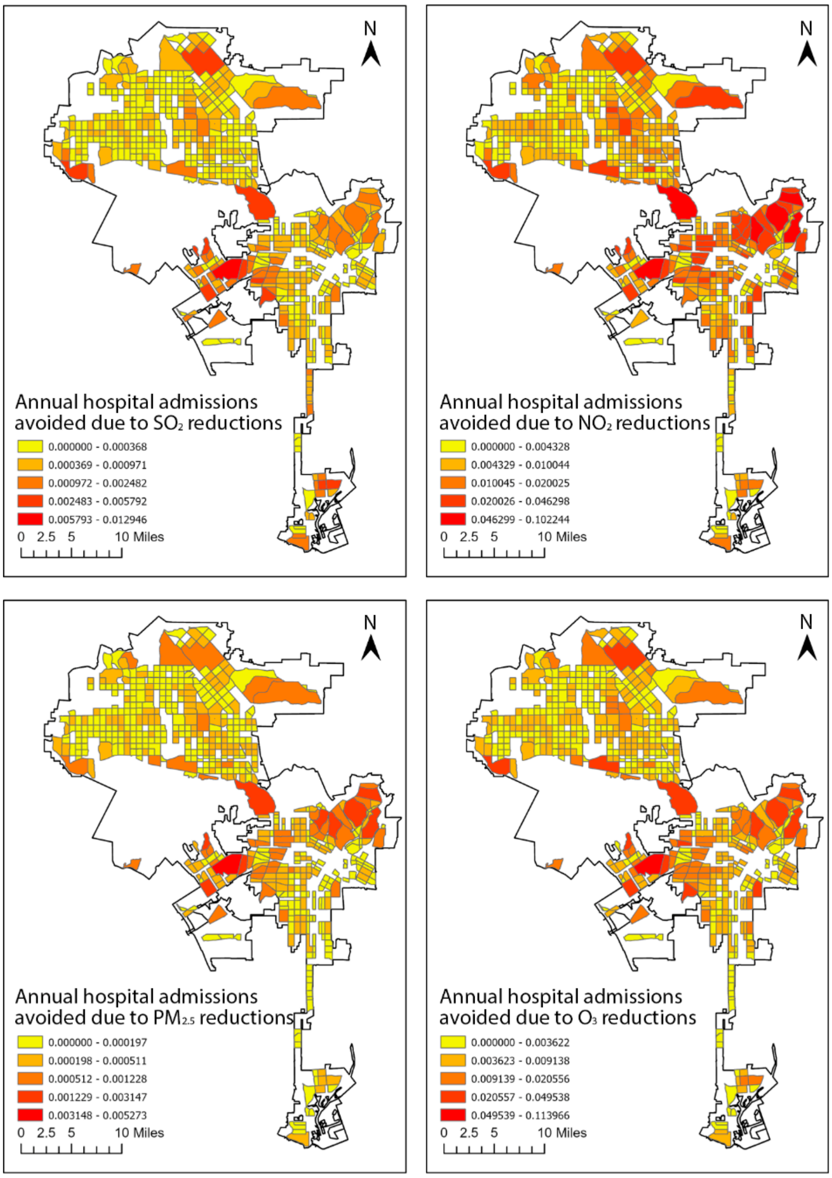


**Figure 4.** Annual hospital admissions avoided due to air pollutant reductions estimated by BenMap-CE.

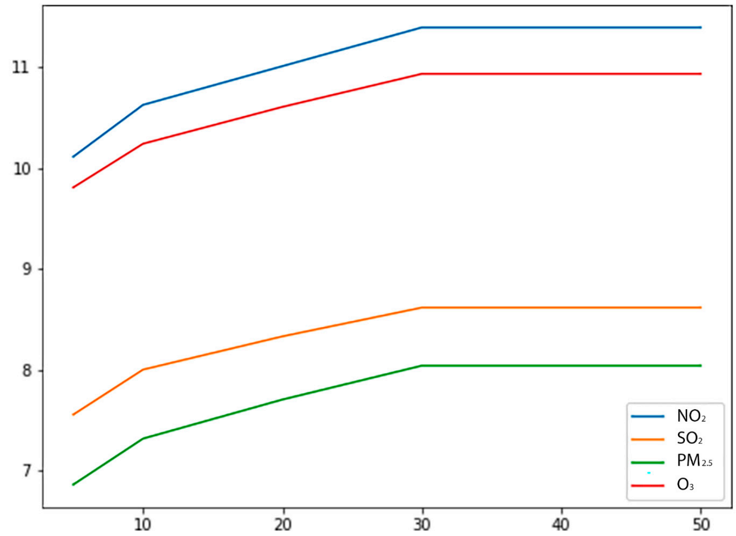


**Figure 5.** Annual ln($) saved from hospital admissions avoided due to air pollutant reductions that could accompany the five Superblocks scenarios.

### *3.5. Slow Streets and Al Fresco Dining Programs*

There were 173 slow street programs located in the City of LA that were approved by the LA Department of Transportation (LADOT), from which 116 streets (~67.1%) were included in the 597 Superblocks of the LA Superblocks Model and 112 streets (~64.7%) were included in the 530 Superblocks analyzed in the five scenarios. Ten of the 1019 slow street programs were in the Superblocks involved in Scenario 1, five streets were added to the Superblocks additionally involved in Scenario 2, 21 streets were added to the Superblocks additionally involved in Scenario 3, 38 streets were added to the Superblocks additionally involved in Scenario 4 and 38 streets were added to the Superblocks additionally involved in Scenario 5.

There were 2273 al fresco dining locations in the City of LA approved by LADOT, from which 1087 locations (~47.8%) were in the 597 Superblocks included in the LA Superblocks Model and 1019 locations (~44.8%) were in the 530 Superblocks analyzed in the five scenarios. One hundred and seventy five of the 1019 al fresco dining locations were included in the Superblocks in Scenario 1, 138 locations were added the Superblocks additionally involved in Scenario 2, 147 locations were added to the Superblocks additionally involved in Scenario 3, 132 locations were added to the Superblocks additionally involved in Scenario 4 and 427 locations were added to the Superblocks additionally involved in Scenario 5.

## 4. Discussion

The LA Superblocks Model proposed in this study prioritized the potential Superblock locations in the City of LA with the help of the five data-driven rules. Defined by these five rules, we used the term Superblocks to refer to a sufficiently large urban area surrounded by major streets or arteries. In order to allow that at least one local street runs between the local main streets and the arteries that border the Superblocks, previous studies have established quantitative standards such as: (1) the minimum schematic expression of Superblocks with local traversing main streets is a 3 × 3 street grid with four internal blocks; and (2) the minimum schematic expression of Superblocks with additional internal streets is a 5 × 5 street grid with 16 internal blocks [28]. Thus, a generalizable Superblocks model must include size in its design. In this LA Superblocks Model, we chose 100,000 square feet and 12 road segments as the thresholds to filter the Superblock candidates to ensure the minimum schematic expression of the Superblocks in the model is greater than a 3 × 3 street grid. However, we suggest future investigations into different types of schematic expression of Superblocks to extend this model to other metropolises.

Urban transformation could be more challenging in cities that have considerably transformed streets and pedestrian streets such as the City of LA [29]. Thus, implementing Superblocks in existing residential areas may be a less-disruptive strategy to start such an urban transformation. Because residential areas not only carry less responsibilities for traffic circulation but also are major sources of the residents' ambient air pollution exposures, they offer good opportunities for implementing Superblocks. After examining the health and economic benefits of five different scenarios by transforming 5–50% of the residential areas in the City of LA, we found that transforming 30% of the residential areas offered the largest improvements in terms of health and economic benefits. Even though implementing more Superblocks into residential areas will provide greater health and economic benefits, the rate of increase slows with further transformation. For example, in the LA Superblocks Model, the minimum schematic expression of Superblocks and the requirements of major streets or arteries on the edge of Superblocks suggest that the maximum percentage should be $\leq$54.8%. More importantly, we found the marginal benefits became imperceptible after 30%. This latter benchmark helps to frame the scale of the Superblock implementation and the accompanying health benefits. This benchmark is very important, because there are various types of political barriers that could hamper the development of Superblocks. For example, in cities with both local and regional traffic, the implementation of Superblocks could lead to increased regional traffic congestion. In this sense, coordinated efforts between the various municipalities in the region are required [30]. Our identified scenarios can help planners and decision-makers in balancing the effectiveness of Superblocks in relation to major changes in physical activity or social cohesion and the possible political barriers and possible negative effects on traffic congestion.

After being introduced in the City of Barcelona, many positive changes were observed in pedestrian mobility, air and noise pollution and the general perception of the neighborhood. Since then, researchers have conducted qualitative studies and surveys to analyze residents' perception of these effects by using various focus groups that are more or less likely to use the Superblocks based on the participants characteristics [22]. In this study, we used the slow streets and al fresco dining programs to anticipate residents' favorable perceptions of Superblocks in order to evaluate the impact of Superblocks. We assumed that the residents who applied for slow streets and/or al fresco dining programs are more open to transforming their neighborhood by reclaiming part of the public spaces from vehicles. The results linked the prioritized Superblock locations and the approved locations of those programs to assess the effectiveness of these kinds of public policy interventions in terms of health and economic benefits.

Our study focuses on the implementation of the Superblocks model in the City of LA, but it also provides an opportunity to compare it with similar models in other cities. The configuration and size of superblocks can vary greatly depending on factors such as population density, transportation infrastructure and local priorities. Cities may have different approaches to implementing superblocks, leading to varying results in terms of health and environmental outcomes. The impact on local economies and transportation systems can also differ, depending on investment in alternative mobility options, stakeholder engagement and local businesses' ability to adapt. Comparing the City of LA's Superblocks model with others, urban planners and policymakers can gain valuable insights into the strengths and limitations of this urban planning strategy and inform their own planning decisions.

## 5. Conclusions

In this study, we proposed a framework to build a generalizable Superblocks model using the City of LA as an example. Based on the assumption that Superblocks crucially free up urban space from car-based mobility by assigning novel uses to street spaces (i.e., urban greening), we conducted a series of analyses using BenMap-CE and the i-Tree tools to estimate the health and economic benefits of implementing the LA Superblocks Model. Our analyses offered insights into opportunities for cities to tackle challenges such as climate change, noise and air pollution, urbanization and the limited availability of urban green space [31]. The methodological assumptions of the five rules we applied in the LA Superblocks Model can also be easily adapted to different cities or other geographical extents. Moreover, the introduced geospatial data-driven methodology for assessing the health and economic benefits of Superblocks can be easily applied to analyses of other air pollutants (e.g., CO or $PM_{10}$) and health outcome indicators (e.g., asthmas or other acute respiratory symptoms). Many existing data sources provide fine-resolution regional air pollution and health outcome data to support the extension of using our framework to assess broader impacts of the Superblocks models (e.g., CalEnviroScreen; California Office of Environmental Health Assessment, 2018). The results of the study urge the consideration of health impacts when designing cities and emphasize the importance of provision of urban greening through Superblock interventions.

In conclusion, the implementation of the Superblocks model in urban planning can have significant benefits for cities, including improved health outcomes, reduced carbon emissions and increased physical activity. However, the success of this strategy depends on several factors, such as population density, transportation infrastructure, stakeholder engagement and investment in alternative mobility options. The results of implementing Superblocks in different cities can vary and it is important for urban planners and policymakers to consider the unique context and priorities of each city when deciding whether and how to implement this strategy. By comparing our findings with similar studies and placing our work within the broader context of the field, we can gain a deeper understanding of what works well and what does not, and inform future planning and implementation efforts.

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