D2.2 Thematic Maps

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Responsible Partner	BAX

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LIST OF ABBREVIATIONS

- BAX – Bax & Company
- CVDs – cardiovascular diseases
- EB – Executive Board
- EMC – Erasmus University Medical Centre Rotterdam
- EU – European Commission
- FISABIO – Foundation for the Promotion of Health and Biomedical Research of the Region of Valencia
- GAP – Grant Agreement
- GA – General Assembly
- GIS – Geographic Information Systems
- HC – Healthy Cities
- HCG – Healthy Cities Generator
- KVC – Kveloce I+D+i
- MEDRI – University of Rijeka Medical Faculty
- NCDs – Non-Communicable Diseases
- NDVI – Normalised Difference Vegetation Index
- T2DM – Type 2 Diabetes Mellitus
- UE – Urban environment
- UPV – Polytechnical University of Valencia
- UVEG – University of Valencia
- WP – Work Package

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EXECUTIVE SUMMARY

The present deliverable presents the process and initial outcomes of **Task 2.2 Characterisation of urban environments**, led by Bax & Company. As part of Work Package 2 "Identifying and measuring the association between urban environment features and NCDs", the purpose of task 2.2 is to first identify which urban characteristics influence NCD risk behaviours, and secondly, assess these characteristics in the three pilot cities (Rijeka, Rotterdam and Valencia). These analyses are visualised in various thematic maps.

Objectives

The objectives of this deliverable are to:

- Provide an overview of the urban characteristics or attributes that are found to influence NCD risk behaviour, following a comprehensive review of the literature.
- Present the process of data collection and analysis in each one of the urban areas, to assess these characteristics.
- Visualise these analyses in a collection of thematic maps.

Organisation of the deliverable

The deliverable is structured in three sections, following the objectives above. The first section summarises the literature review, leading to the identification of relevant urban attributes. The second chapter focuses on the data collection process and presents the rationale established to carry out the urban analyses. The third section presents the thematic maps, resulting from the analysis.

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LITERATURE REVIEW

The aim of this literature review is to identify and classify urban environment features linked to health, specifically risk-behaviours for NCDs. The review builds upon two previous literature reviews.

This section describes the various stages of research that were conducted, both prior to the HORUS project, and as part of it.

Background

With the aim of identifying associations between urban planning attributes and health outcomes, an initial systematic review of the literature was carried out by the University of Vic, Vic City Council, Open University of Catalonia, and the Barcelona Provincial Council. Bax team members were part of the research team that took part in the study.

This systematic review was complemented with a review of grey literature, providing real-life urban planning actions that had influenced health outcomes. In a second stage, the evidence reviewed was critically appraised by key stakeholders from urban planning and public health.

As a result, statistically significant relationships were found to link 16 urban planning attributes and 21 health outcomes.

Updated umbrella review of the literature

Following on from the initial literature review, BAX conducted an umbrella review to include additional evidence published between 2018 and 2021.

In order to review the scientific evidence systematically, the PRISMA protocol was followed. Only studies written in the English language were included.

The PubMed database was consulted for articles published between 2018 and 2021. For consistency, the same set of keywords was applied. However, as significantly more research has been conducted in this field since 2017, for this review only existing

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systematic reviews were included to ensure a rapid but high-quality evaluation of the evidence base.

After initial screening for relevance, systematic reviews found were included or excluded as follows:

Inclusion criteria

- Systematic review investigating the association between urbanistic indicators, health indicators and lifestyle indicators.
- English language.

Exclusion criteria

- Studies investigating urbanistic indicators in spaces of private use (not within the public realm) or indoor spaces.
- Studies focusing exclusively on clinical populations.

The initial search resulted in 86 systematic reviews identified. This was followed by an initial selection process in which 68 studies were identified as meeting the established inclusion and exclusion criteria by reading the titles. Following this, a review of the abstracts of the 68 studies led to the further exclusion of a number of studies, resulting in 45 appropriate studies. Of these, the full-text articles were read, and the data extracted was incorporated into the final table.

Following this stage, a total of 20 urban planning attributes (Urban Determinants of Health) and 30 related health indicators were identified.

These urban attributes were grouped into 5 categories: density (n=2), mobility and transport (n=6), mixed-use and proximity (n=5), environment and landscape (n=5), and housing & energy (n=2). These attributes were linked to 30 health indicators, 7 of these were labelled as environmental or lifestyle determinants of health and 23 were considered direct health outcomes. In total 5 categories of health indicators where established: environmental determinants of health (n=3), lifestyle determinants of health (n=4), physical health outcomes (n=13), mental health outcomes (n=7) and wellbeing (n=3).

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Literature review on NCD risk behaviours

Within the frame of the HORUS project, and with the purpose of extracting associations between urban environment attributes (Urban Determinants of Health) and risk behaviours linked to the prevalence of NCDs, an ad-hoc review of the previous evidence was conducted.

The WHO's '4x4 framework for NCDs' identifies 4 behavioural "lifestyle" risk factors that are linked to the 4 main NCDs: unhealthy diet, physical inactivity, tobacco, and alcohol use. These fall under 3 of the lifestyle factors identified previously in the literature review: physical activity (PA), sedentary behaviour (SB), and food environment (FE). No explicit links were found to alcohol or tobacco; however, some studies reference them indirectly, considering the proximity to commercial outlets or preponderance of liquor stores.

We reviewed the existing literature to extract papers that focused on these lifestyle risk factors as a primary or secondary outcome. Excluding studies that were unrelated to lifestyle factors resulted in 87 relevant studies. The following table visualises the resulting associations between 18 urban attributes and 3 lifestyle risk factors:

		Lifestyle factors		
		PA	SB	FE
Density	Population and residential density			
	Business and retail density			
Mobility and Transport	Street connectivity and intersection density			
	Connection to relevant places			
	Cycling infrastructure			
	Walkability/pedestrian infrastructure			
	Availability of public transport			
	Speed and/or volume of traffic			
Mixed-use and proximity	Residential proximity to diverse social services			
	Residential proximity to sports facilities			
	Residential proximity to recreational amenities			
	Residential proximity to public open spaces			
	Food environment			

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Environment and landscape	Green coverage and green visibility			
	Proximity to and visibility of blue spaces			
	Diversity of green areas			
	Continuity of the green infrastructure			
	Urban landscape and amenities in public open space			

Figure 3. *Table of associations between urban attributes and NCD lifestyle risk factor*

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CHARACTERISING URBAN ENVIRONMENTS

Data collection

The purpose of collecting data is to conduct the urban analyses of each three cities, using GIS software (QGIS). The approach to the analysis, as defined initially, will be the same for all three cities, to enable comparison and insights into the state of the previously identified urban attributes in each one. These characteristics will be assessed at neighbourhood level, in order to then perform a second spatial analysis (task 2.3) in relation to NCD incidence and risk-behaviour data collected in task 2.1.

Initially, various data sources were reviewed for each city. These included municipal open databases (Data Rijeka, Rotterdam dataplatform, Valencia opendata), as well as national or regional sources (Croatian Ministry of Economy and Sustainable Development, Dutch National Institute for Public Health and the Environment, Rotterdam Rijnmond region health map, Spanish National Institute of Statistics).

Certain limitations were encountered in relation the data available. Some data was open for visualisation but not downloadable, other source contained non-geolocalised data, difficulting the process. Some cities lacked data on certain attributes (such a cyclability or business density). Additionally, some of the relevant attributes, such as walkability, or green connectivity, are complex to quantify with objective data.

Due to the limitation and the heterogeneity of available data, other global or european datasources that could provide similar data for all three cities was also consulted (OpenStreetMap, General Transit Feed Specification, Corine Land Cover, NASA Earthdata & Landsat data). A full list of data sources can be found in Annex 1.

Definition of attributes

The characterisation of the urban environments is based on four groups of variables: physical & functional attributes (as identified in the literature review), socioeconomic attributes, and prevalence of NCD risk-behaviours.

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A full list of all attributes, as well as tables identifying the indicators used to evaluate them can be seen in section 3: Thematic Maps. Detailed descriptions of attributes are included in Annex 2.

Methodology

Upon analysis of all available data sources, a methodology was defined to perform the various analyses:

1. **Data extraction:**

Data for physical & functional attributes was primarily extracted from open sources, to ensure homogeneity in the data available for each city.

Additional data was extracted from city or country-specific datasets, for socioeconomic and environmental attributes.

Data regarding prevalence of NCD risk behaviour was provided by EMC, UVEG.

Data on prevalence of NCD risk behaviour was not available for Rijeka. The city is currently conducting a survey to collect this information, and it will be included in the analysis when available.

2. **Data analysis**

Using Geographic Information software (QGIS), the data was processed, and a series of analyses were performed to evaluate each attribute.

3. **Visualisation**

As a result, a series of thematic maps were produced to visualise the results of the analyses.

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THEMATIC MAPS

Physical, functional & socioeconomic characteristics

Variables analysed:

1. Density:
    a. Population density: Net population density
    b. Business and retail density: Economic activity
2. Mobility
    a. Street connectivity: Number of intersections with 3 or more streets per km^2/Ha
    b. Location connectivity:
        i. Number of points of interest accessible within (radio of influence) m (per facility, service)
        ii. Global connectivity to services
    c. Cyclability[1]:
        i. % of streets with cycle infrastructure
        ii. number of bicycle stations or parking facilities within 500m
    d. Walkability:
        i. Number of pedestrian facilities
        ii. Street slopes (topography)[2]
        iii. Accessibility
    e. Public transport:
        i. Stations accessible within 1km
        ii. Availability of stops-stations within 500m
    f. Traffic:
        i. % of inhabitants exposed to traffic (and noise exposure)
        ii. % of area where motorised traffic is not permitted or restricted
3. Mixticity
    a. Proximity to public spaces: Number of open public spaces within 500m
    b. Food environment: Number of food related (fresh-food and grocery shops, urban agriculture and allotment areas) services within 500m
4. Green infrastructure
    a. Green coverage:
        i. Normalised difference vegetation index (NDVI)
        ii. Surface area of green space per inhabitant
5. Socioeconomic status

[1] These analyses have not been carried out for the city of Rijeka due to the absence of cycling infrastructure.

[2] This analysis has not been done for Valencia and Rotterdam as they show little topographical alteration.

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a. Average disposable income per dwelling
b. Percentage of population with higher education

The following table describes the data used and analysis for each of the indicators:

Map (indicator)	Dataset (input)	Analysis
1.a. Net population density	Population census	Population density per neighbourhood.[3]
1.b. Economic activity	Location of services, shops, commerce	Points (location) density analysed on a 500-metre cells grid of the city.
2.a. Number of intersections with 3 or more streets per km²/Ha	Streets network	Grid with the density of road intersections with 3 or more streets.
2.b.i. Number of points of interest accessible within [radio of influence] m (per facility, service)	Location of: - facilities, services - green areas (parks)	Calculation of iso-areas (area of influence over a distance to destination) for each kind of facility, service.
2.b.ii. Global connectivity		Overlay of the set of iso-area analyses to obtain the global facilities and services coverage.
2.c.i. % of streets with cycle infrastructure	Cycle infrastructure	Grid with the calculation of the percentage of cycle infrastructure in relation to the total road network.
2.c.ii. Number of bicycle stations or parking facilities within 500m	Location of bicycle stations, parking	Grid with the density of points (location).
2.d.i. Number of pedestrian facilities	Location of pedestrian facilities	Grid with the density of points (location).
2.d.ii. Street slopes	Topography	Grid with the density of contour lines. Based on the DEM (Digital Elevation Model).
2.d.iii Accessibility	Streets network	Grid with the accessible area of the street network in relation to the theoretical area from the centroid of each cell.
2.e.i Stations accessible within 1km	Location of main stations, stops	Calculation of the iso-areas at a distance of 1km for the main public transport stations.
2.e.ii. Availability of stops-stations within 500m	Location of public transport stops	Grid with the density of public transport stops.
2.f.i % of inhabitants exposed to traffic (and noise exposure)	Streets (railway) network Residential areas	Analysis of residential areas affected by traffic and noise generated by the main communication routes (roads, railway), using buffer.
2.f.ii % of area where motorised traffic is not permitted or restricted	Streets network Pedestrian network	Grid with the calculation of the percentage of pedestrian infrastructure in relation to the total road network.
3.a. Number of open public spaces within 500m	Location of open public areas	Grid with the density of points (location of areas centroids).
3.b. Number of food related (fresh-food and grocery shops, urban agriculture and allotment areas) services within 500m	Location of: - fresh food and grocery shops - urban agriculture or allotment areas	Grid with the density of points (location).

[3] An attempt was made to use the residential land layer - instead of neighbourhoods - for a more accurate analysis, but as the data sources were of different origin, there were many calculation errors generated, so the reference layer used is the administrative one for neighbourhoods.

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4.a.i. Normalised difference vegetation index (NDVI)	Normalised difference vegetation index	NDVI calculation using Landsat 8 images.
4.a.ii Surface area of green space per inhabitant	Location of green areas	Calculation of green space area per inhabitant for each neighbourhood considering NDVI values above 0,33.
5.a. Average disposable income per household		Average disposable income per household, per neighbourhood
5.b. % of population with higher education		% of residents with higher education qualification per neighbourhood

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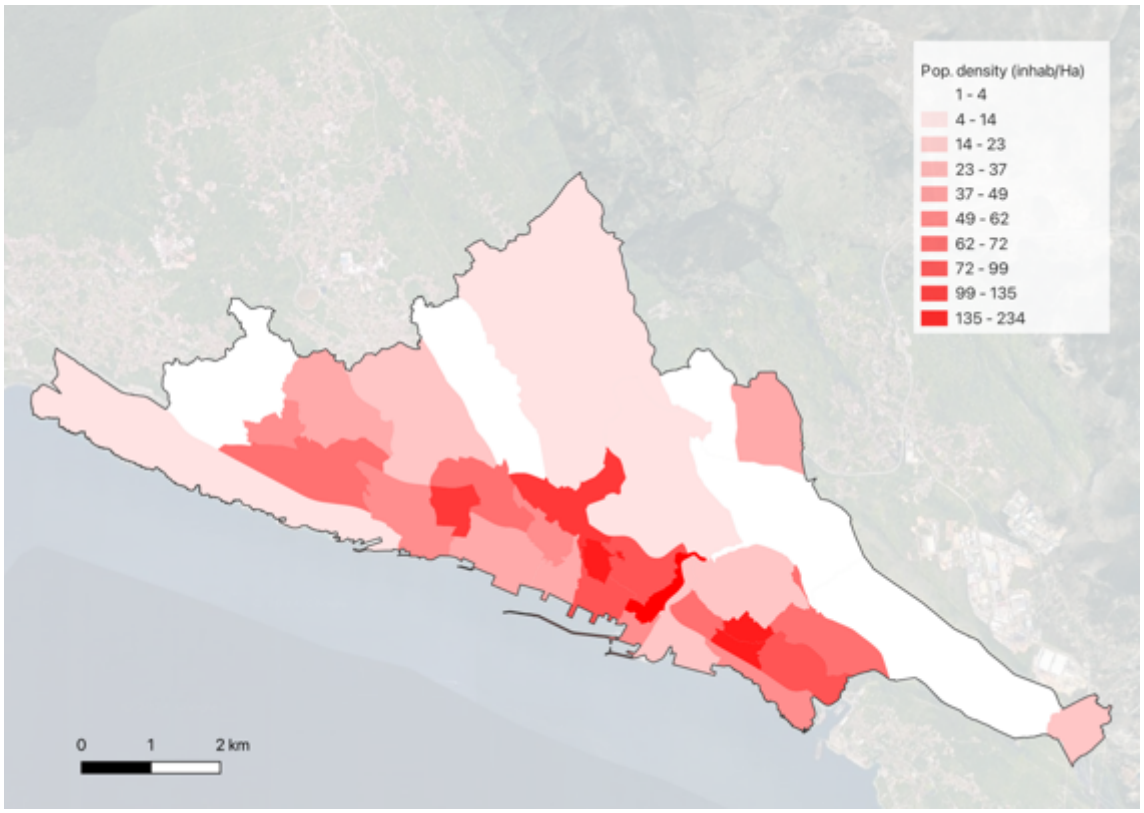
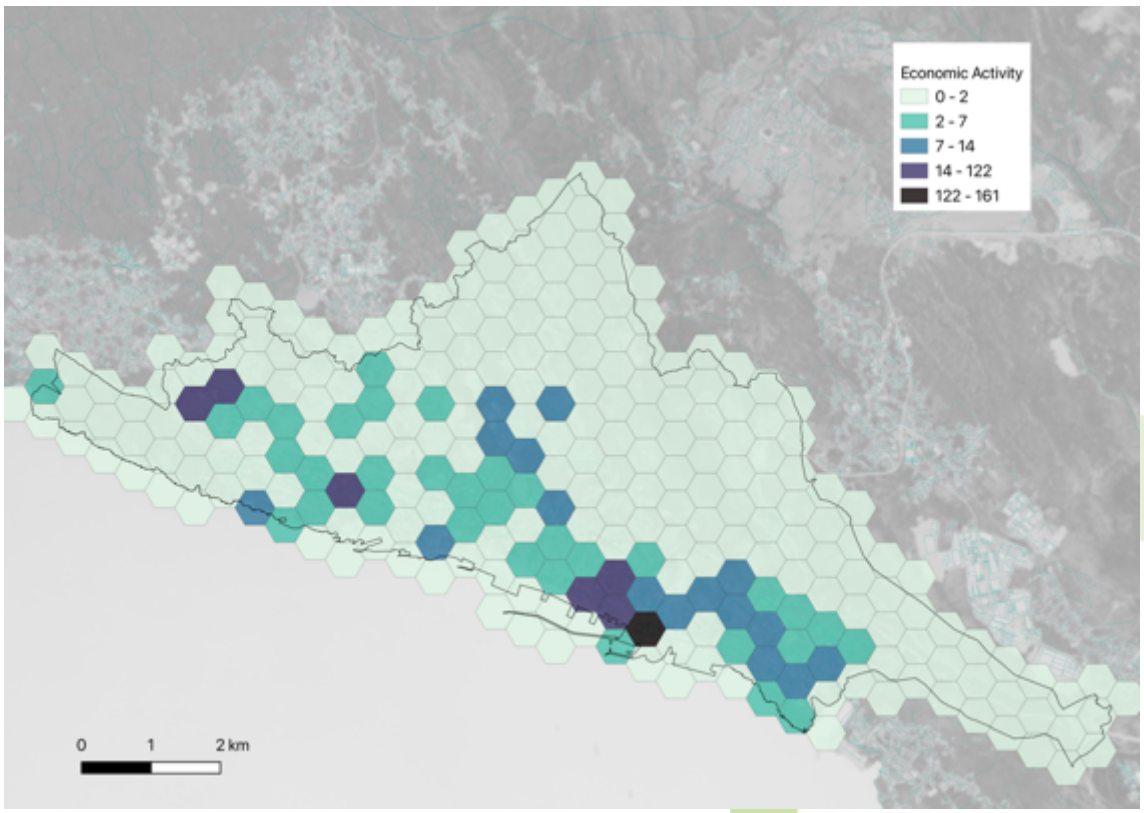
Rijeka



1.a. Net population density



1.b. Economic activity (number of shops, business)

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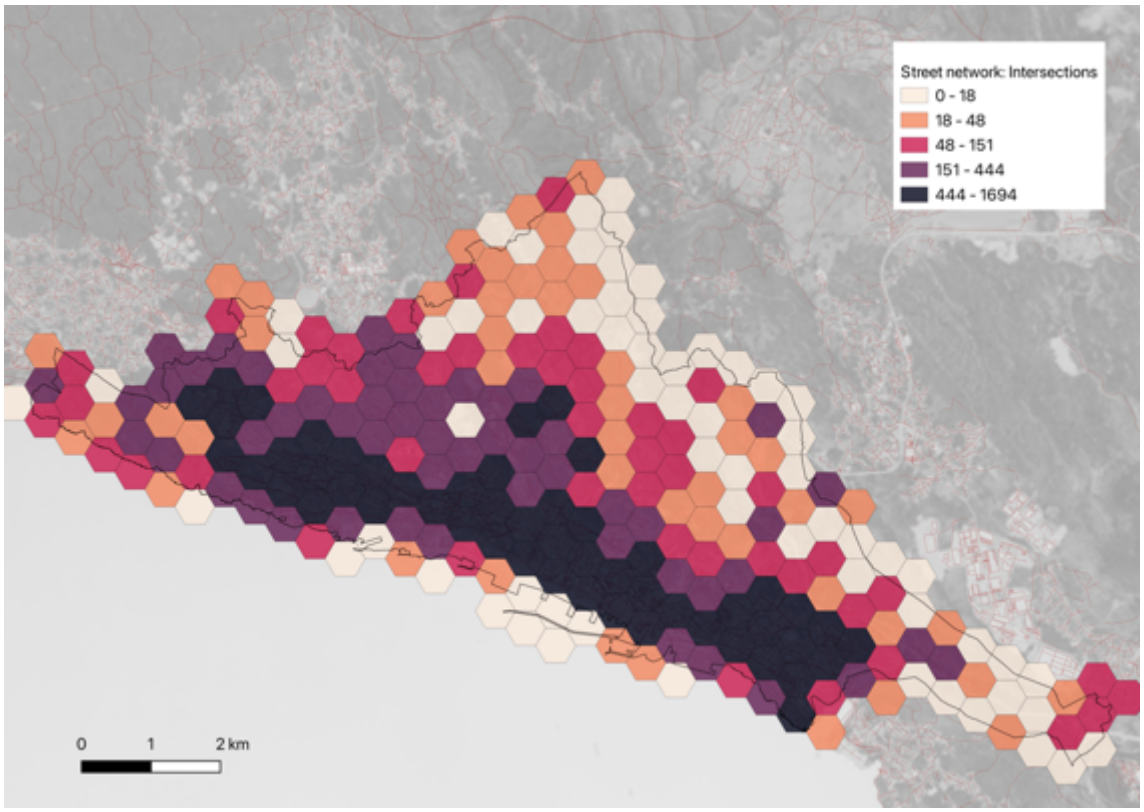
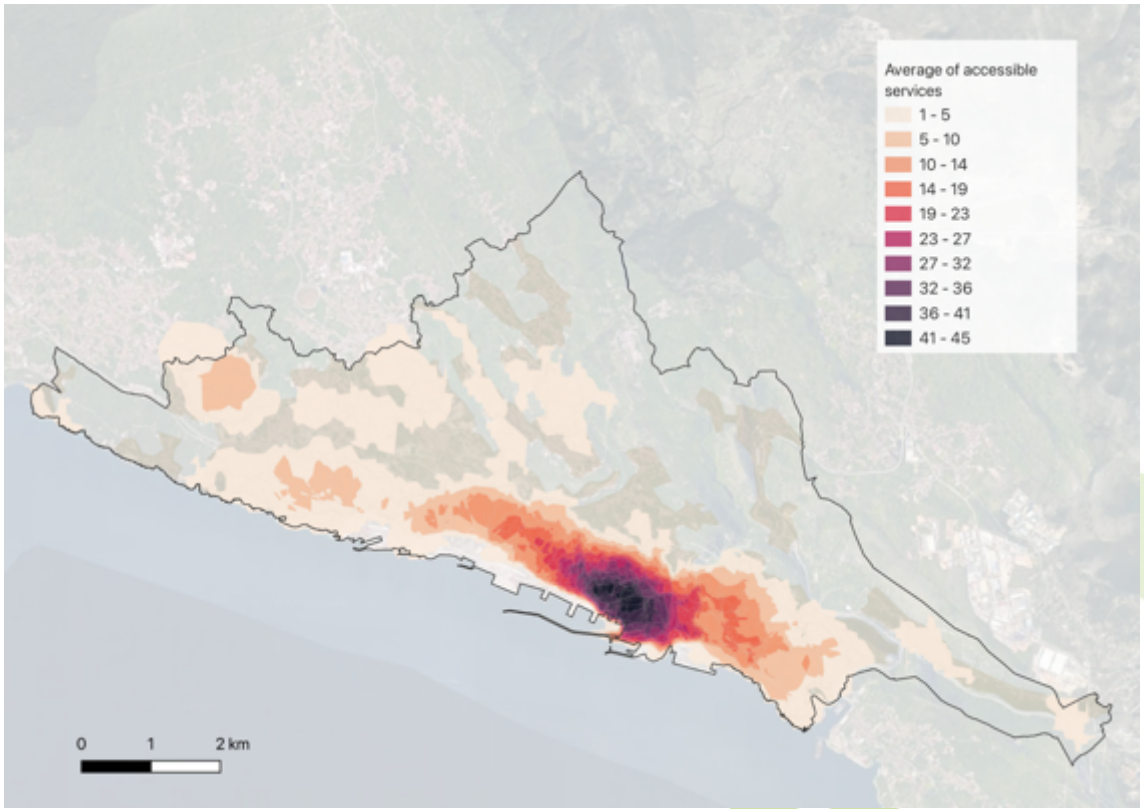


2.a. Number of intersections with 3 or more streets per km²/Ha



2.b.ii. Global connectivity to services

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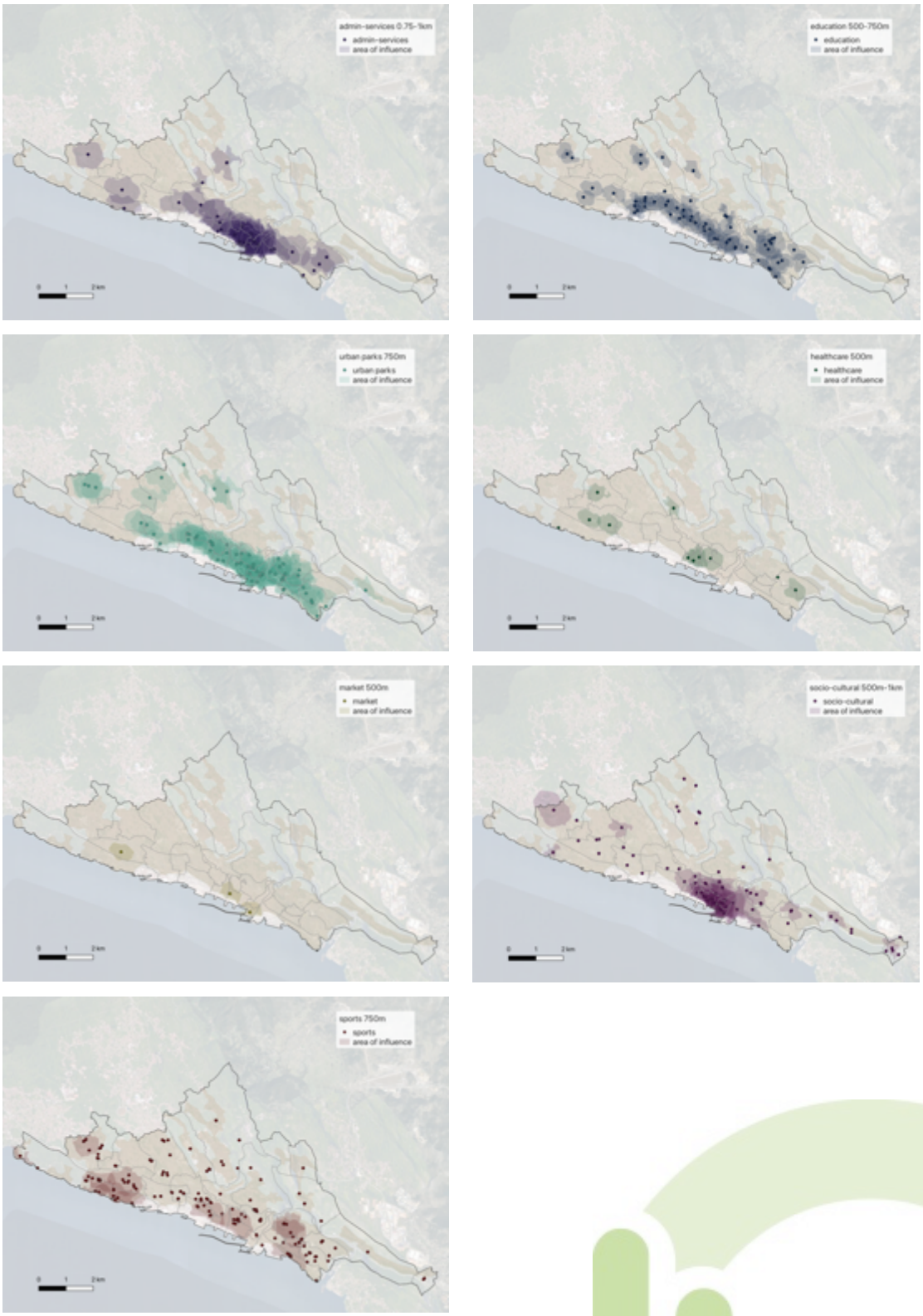

2.b.i. Number of points of interest accessible within [radio of influence] m (per facility, service)

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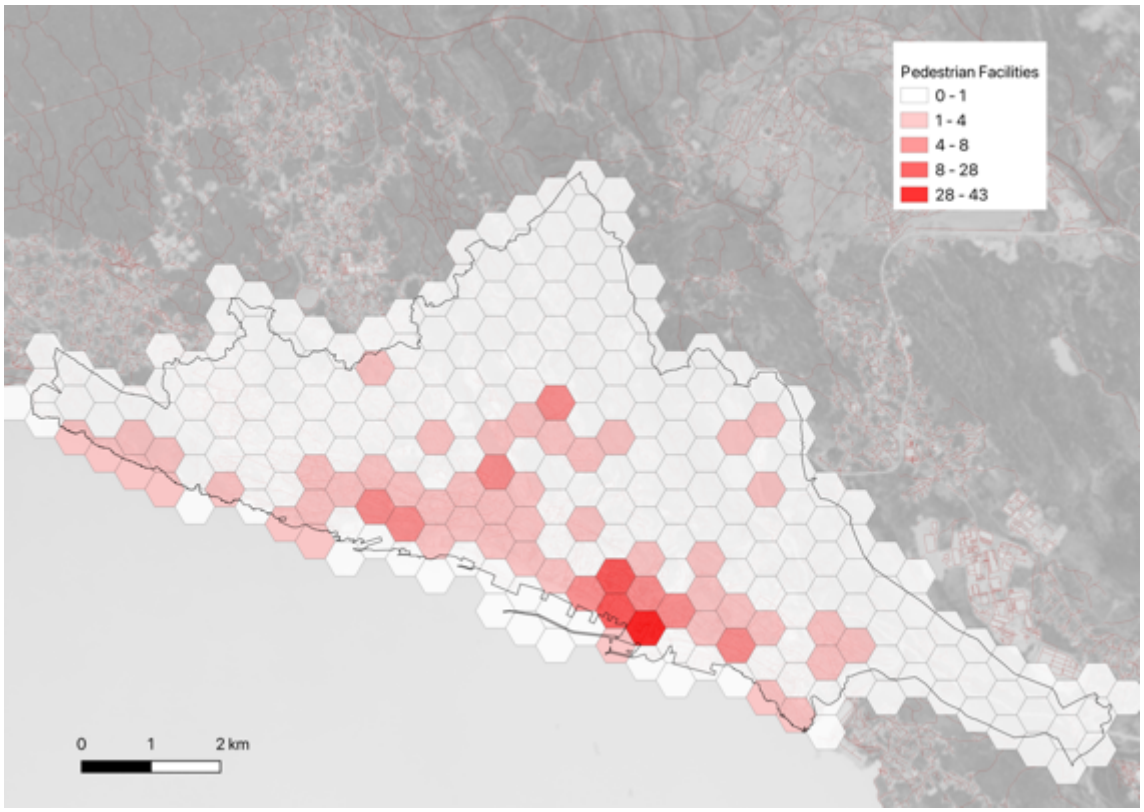
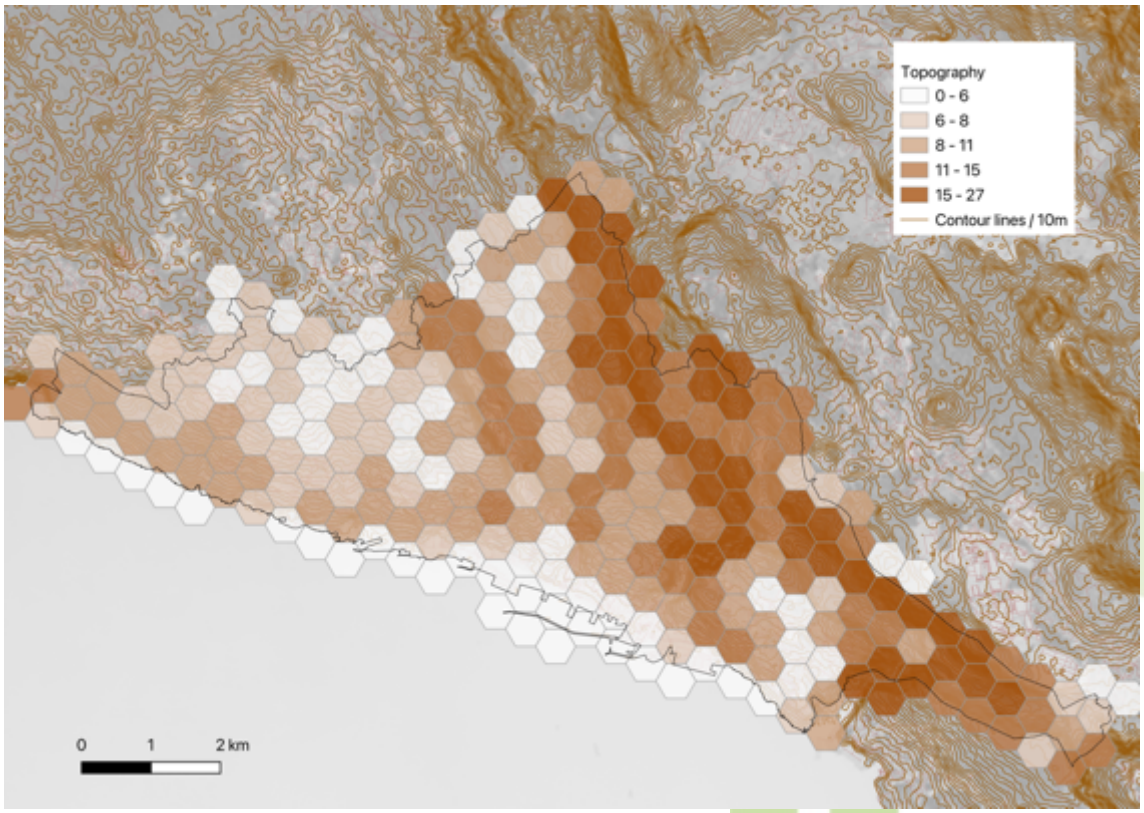


2.d.i. Number of pedestrian facilities



2.d.ii. Street slopes (density of contour lines)

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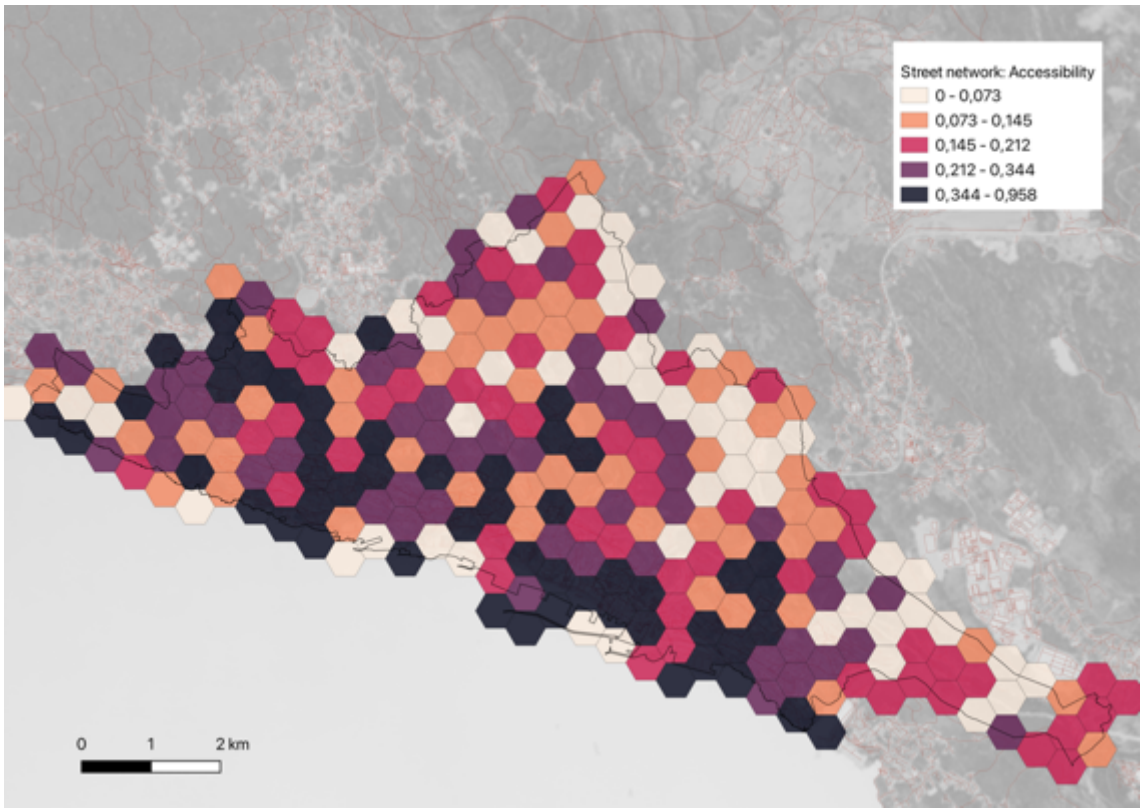
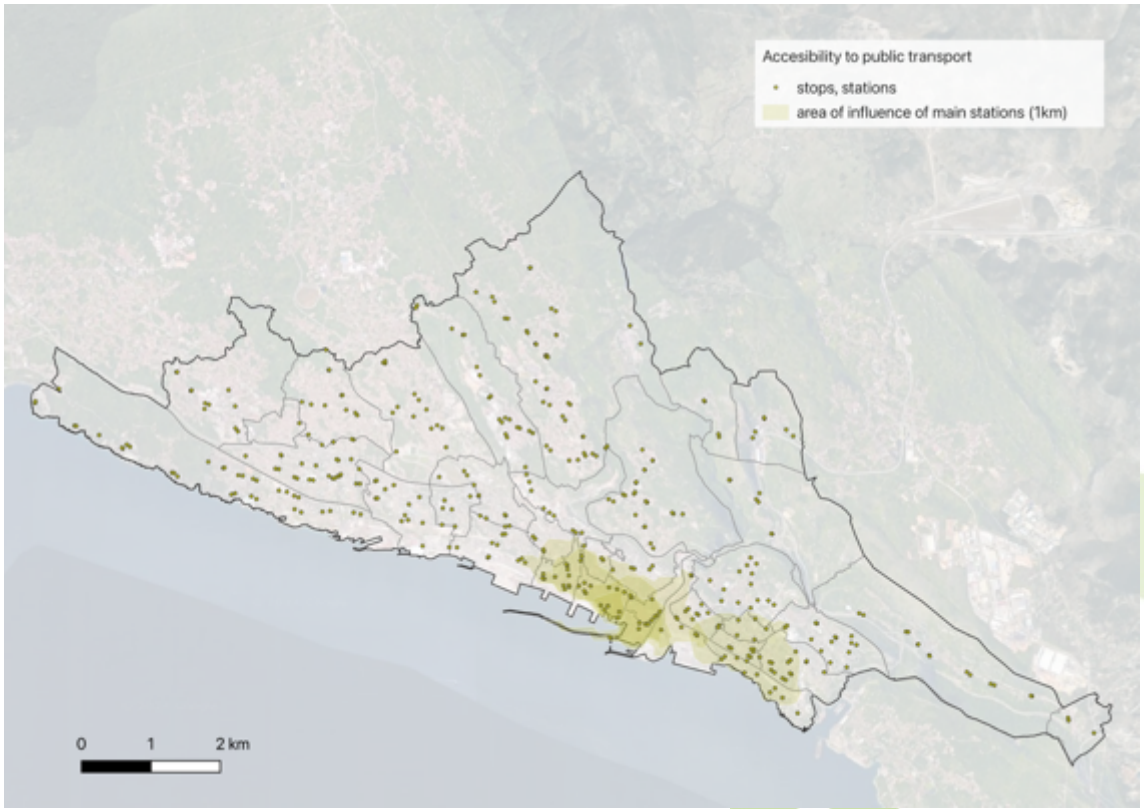


2.d.iii Accessibility (relation of areas accessible within the cycling and pedestrian network, 0 low - 1 high)



2.e.i Stations accessible within 1km

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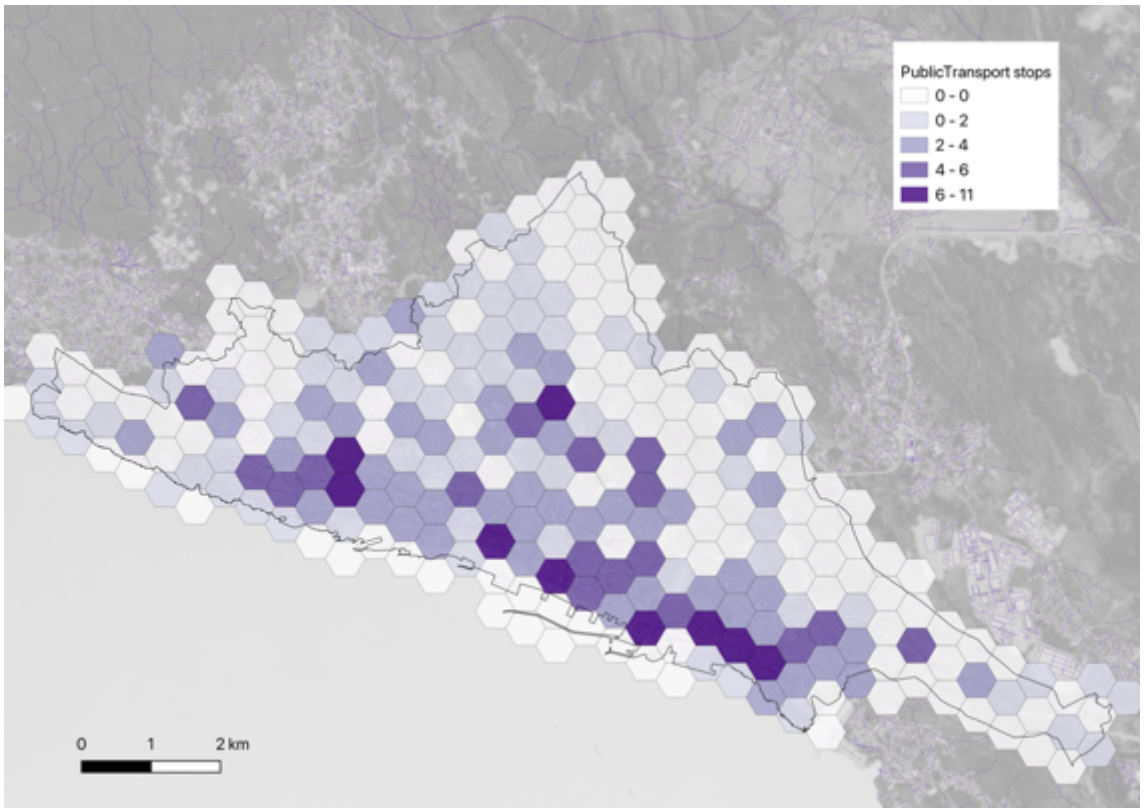
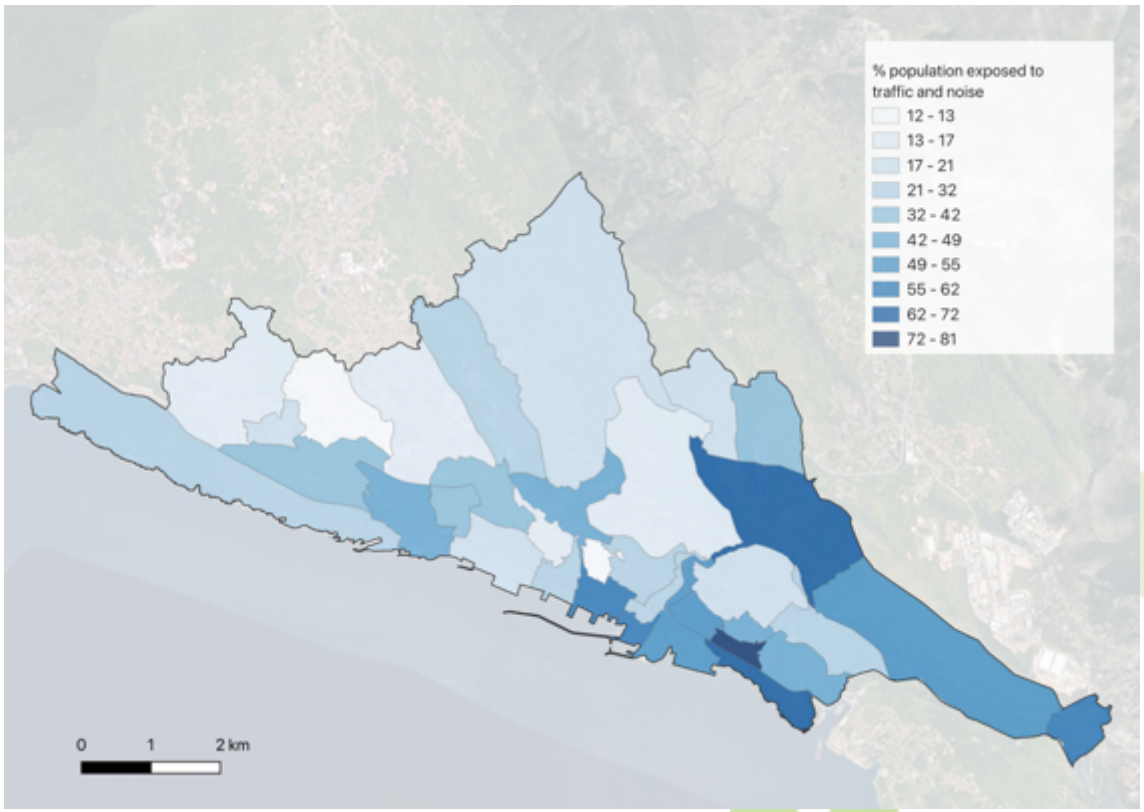


2.e.ii. Availability of stops-stations within 500m (number of stops and stations per cell)



2.f.i % of inhabitants exposed to traffic (and noise exposure)

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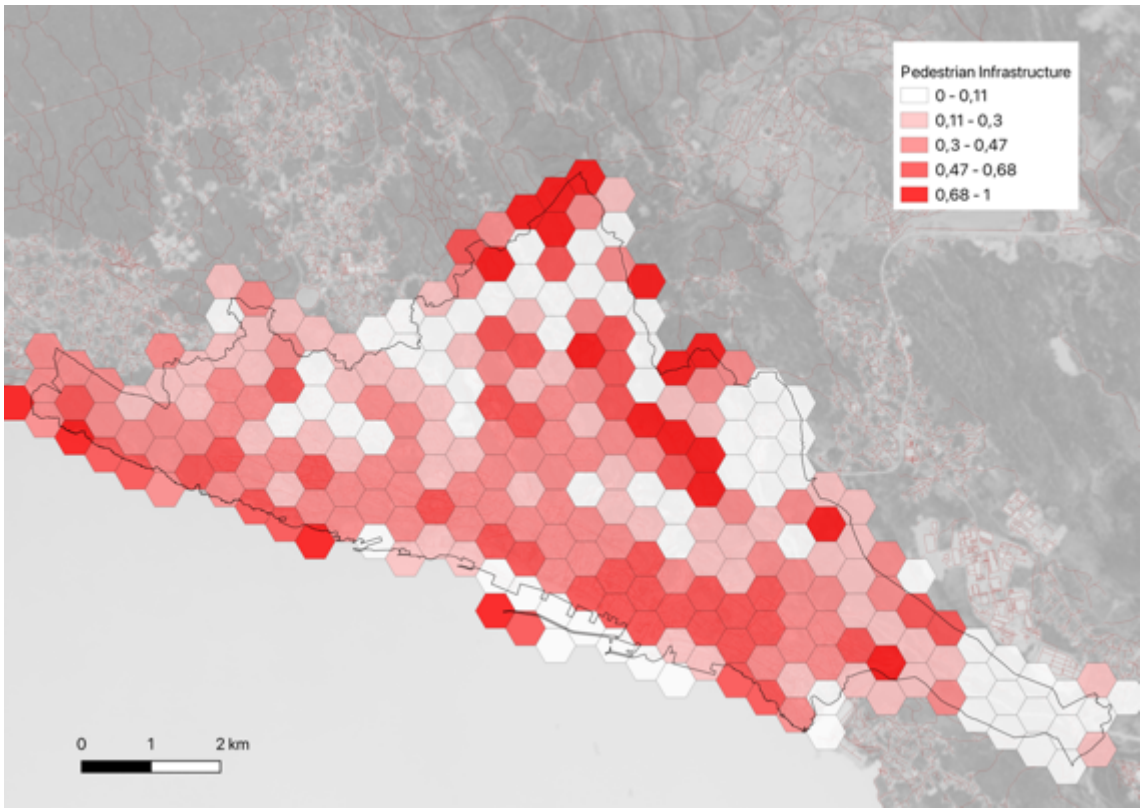
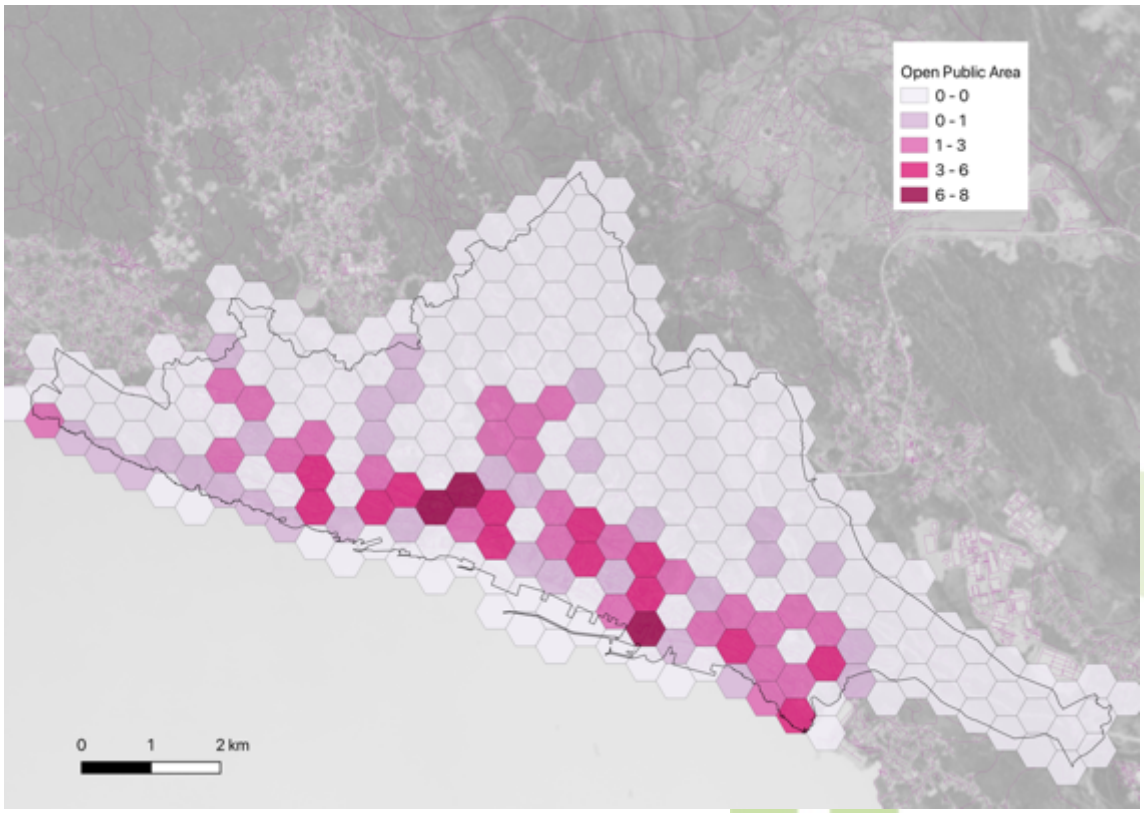


2.f.ii % of area where motorised traffic is not permitted or restricted



3.a. Number of open public spaces within 500m

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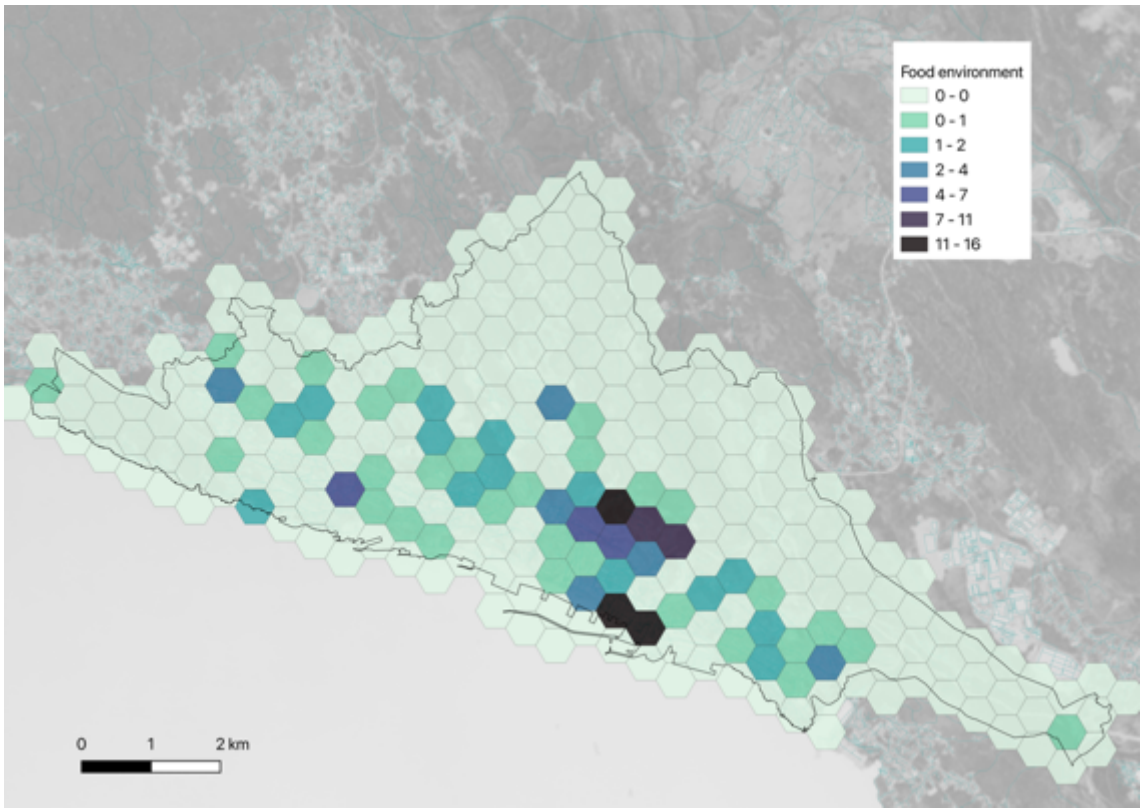
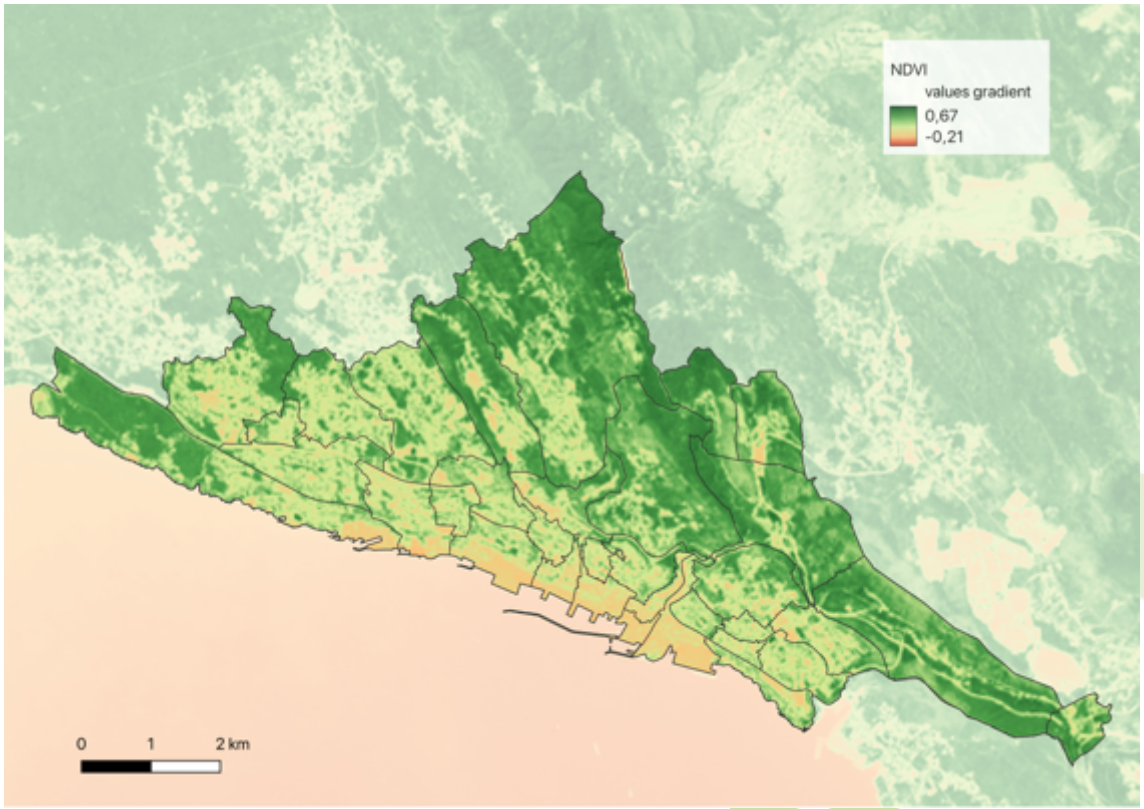


3.b. Number of food related (fresh-food and grocery shops, urban agriculture, allotment areas) services within 500m



4.a.i. Normalised difference vegetation index (NDVI)

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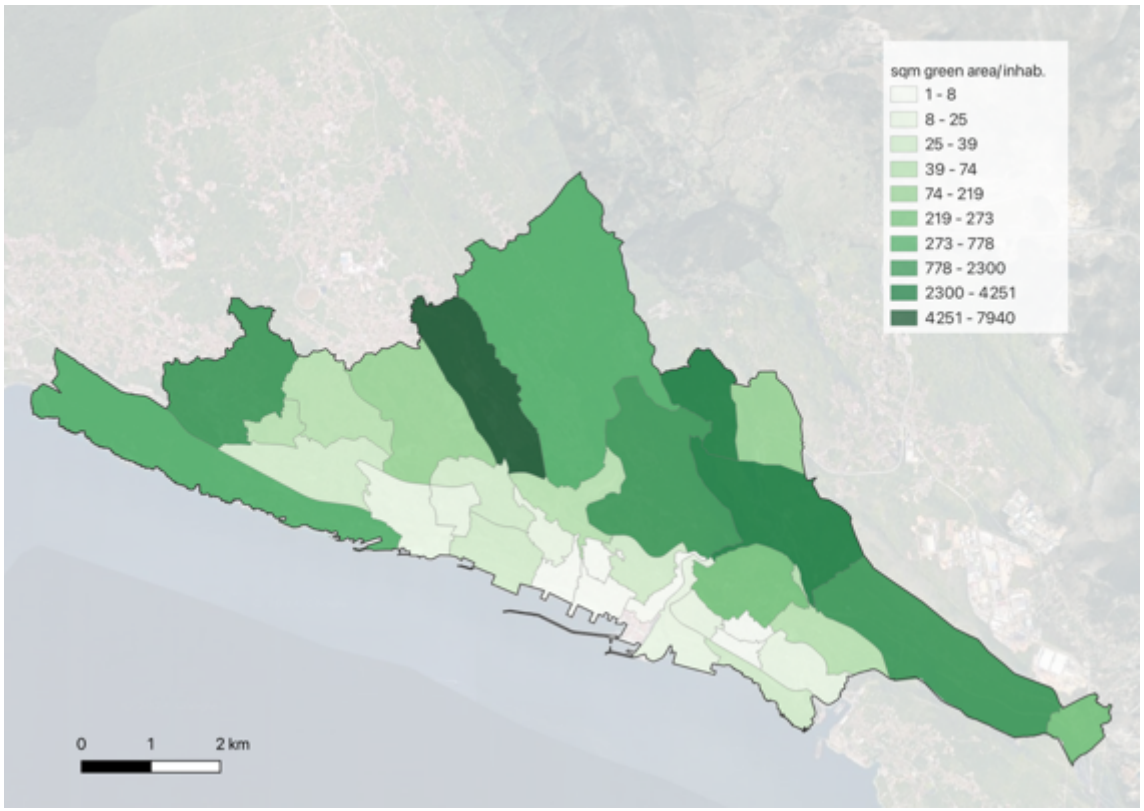

4.a.ii Surface area of green space per inhabitant

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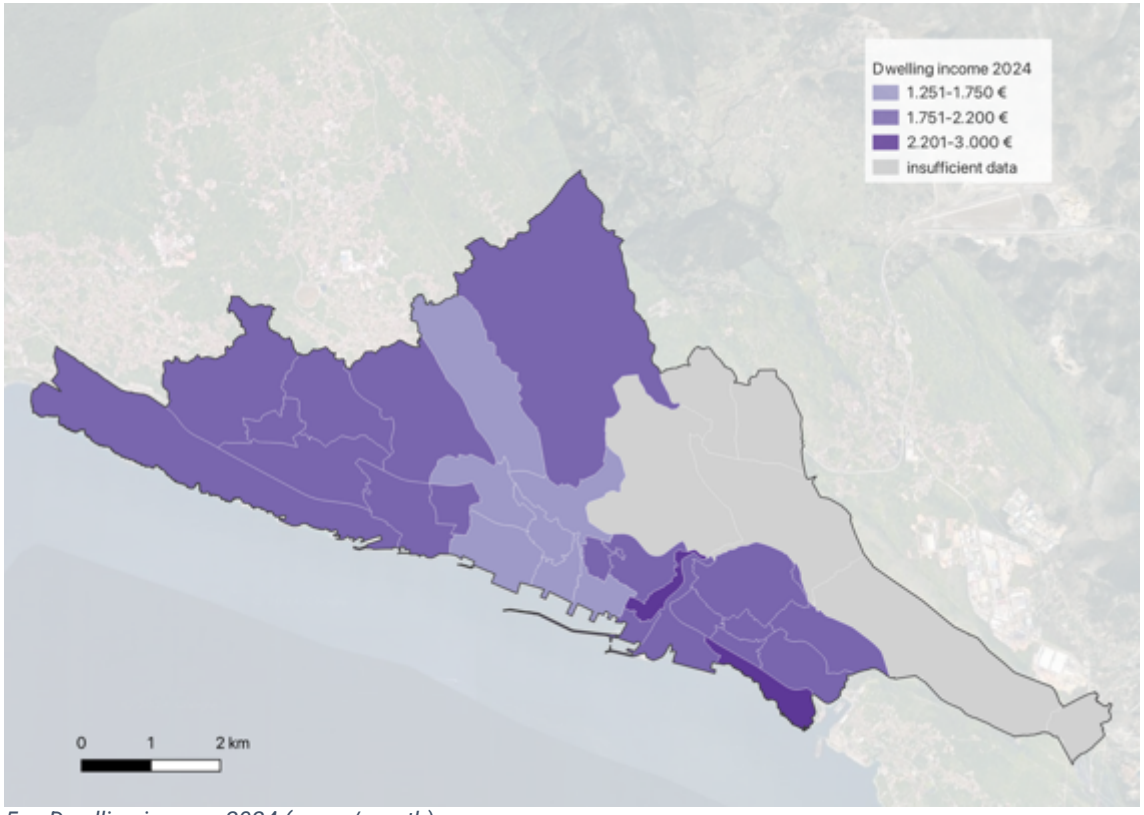
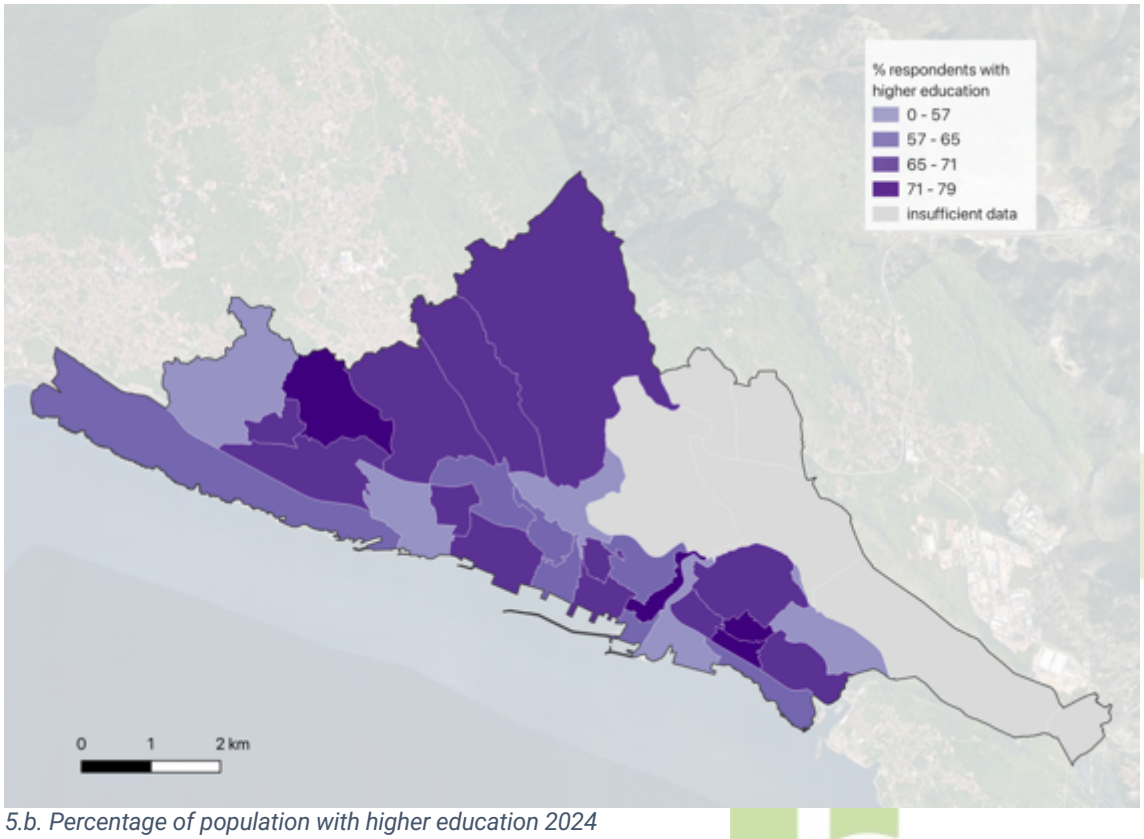
SOCIOECONOMIC ANALYSIS



5.a. Dwelling income 2024 (euros/month)



5.b. Percentage of population with higher education 2024

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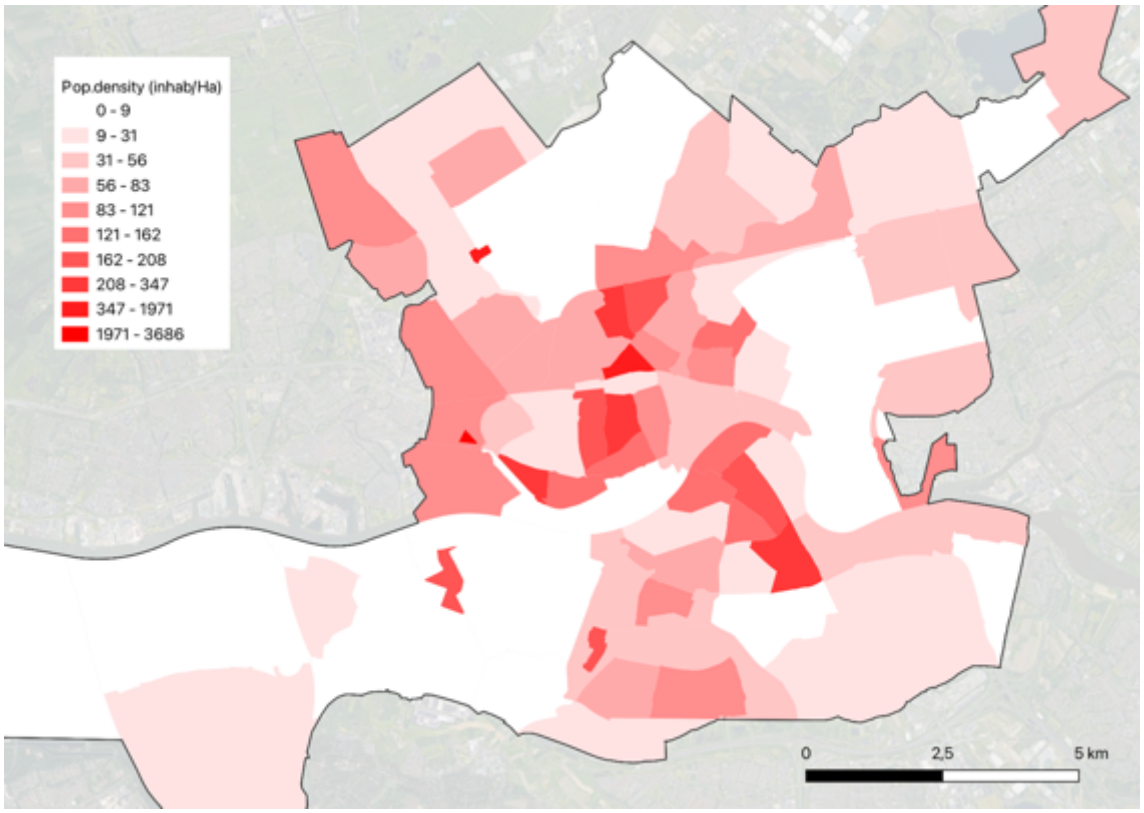
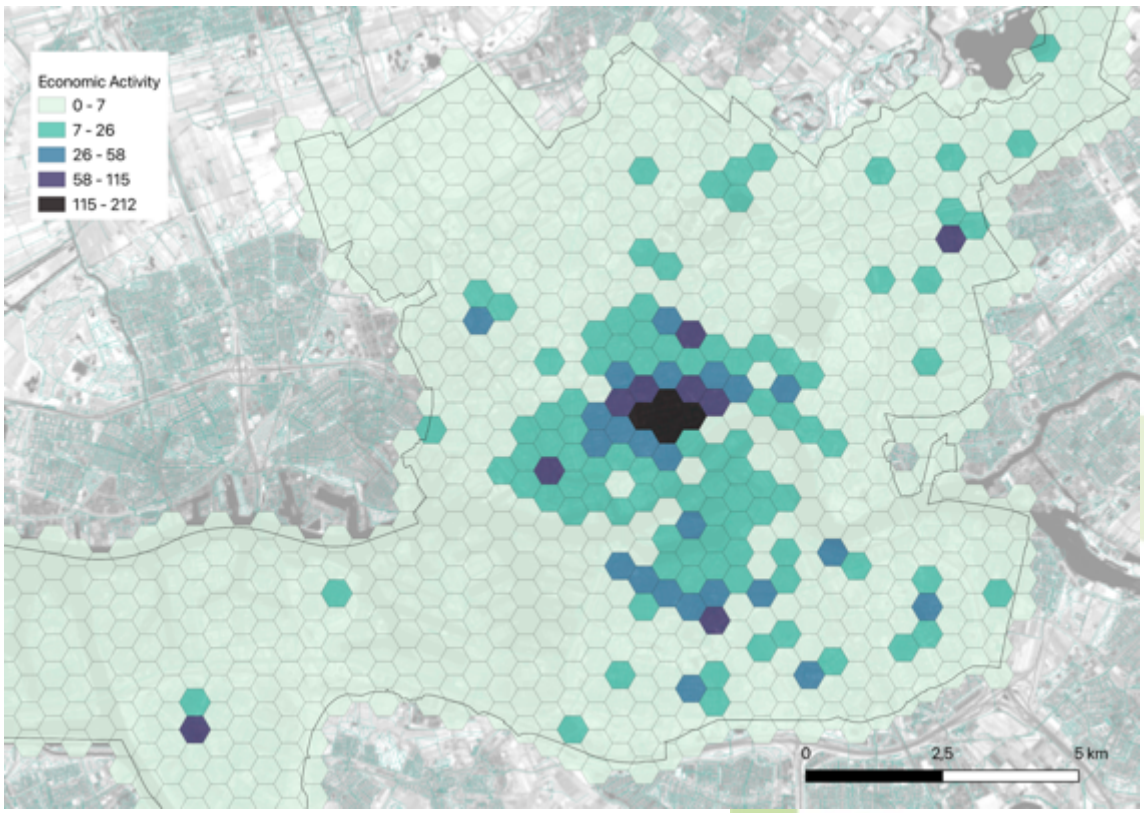
Rotterdam



1.a. Net population density



1.b. Economic activity (number of shops, business)

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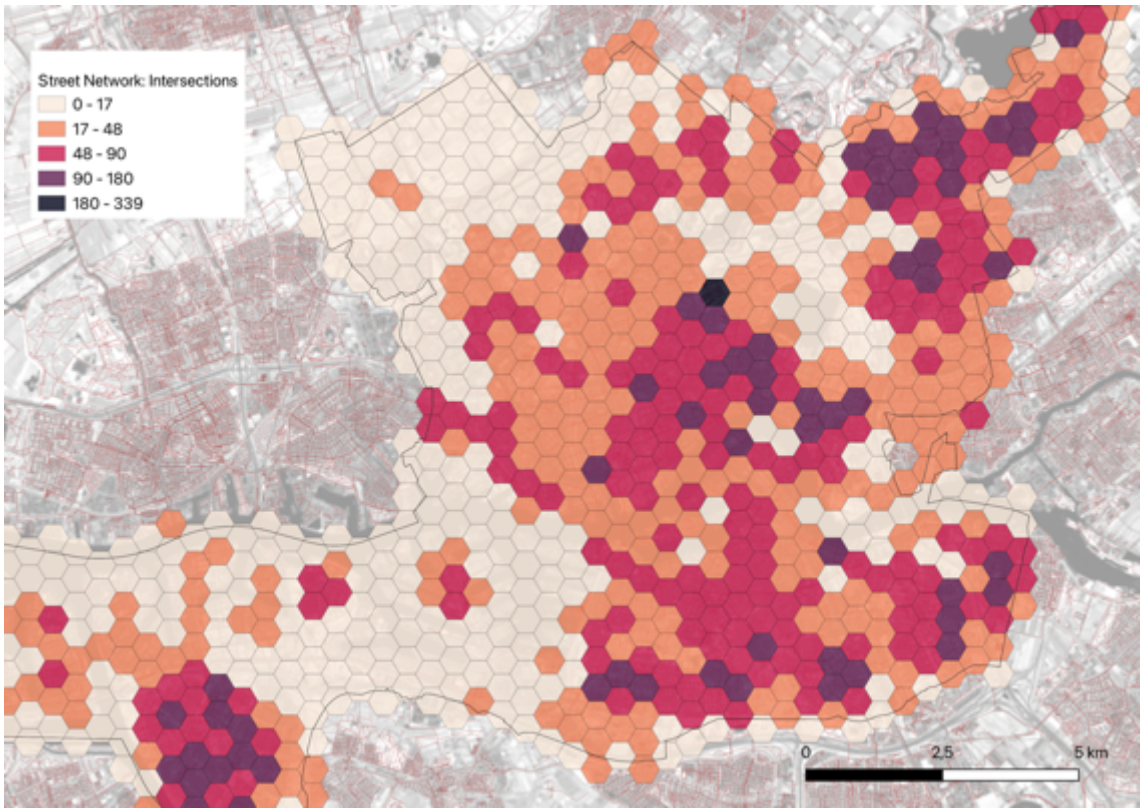
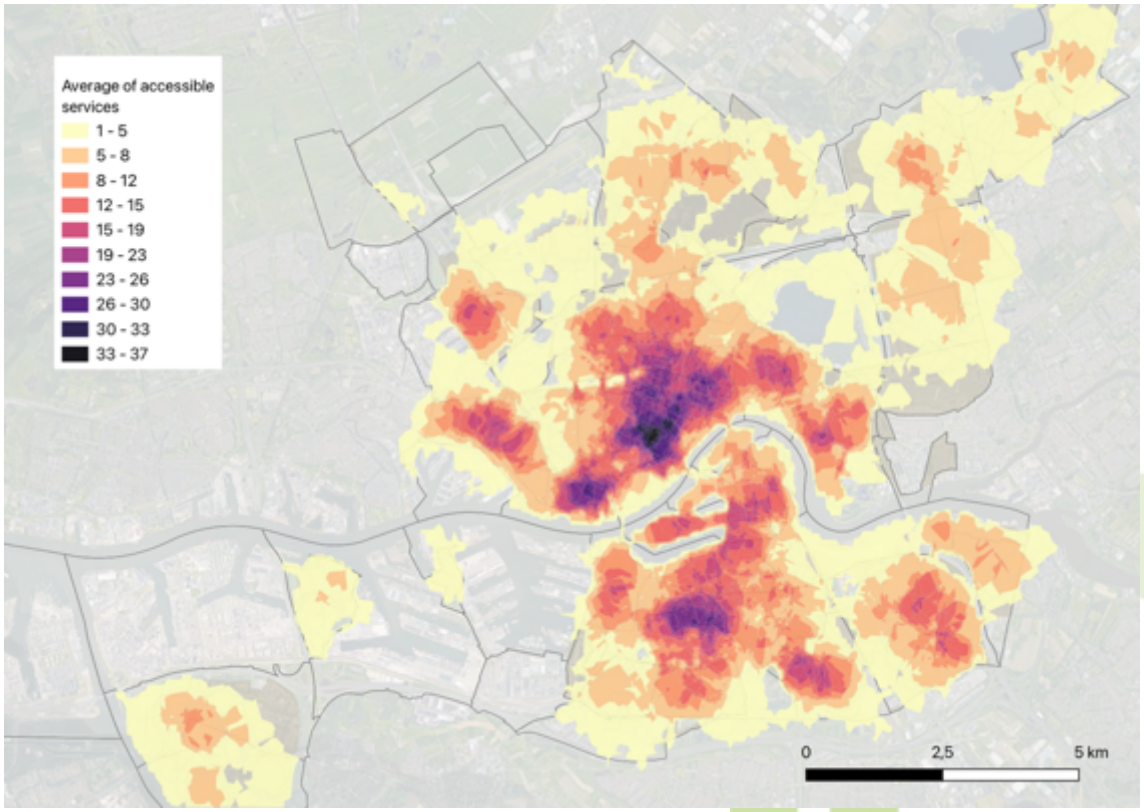


2.a. Number of intersections with 3 or more streets per km²/Ha



2.b.ii. Global connectivity to services

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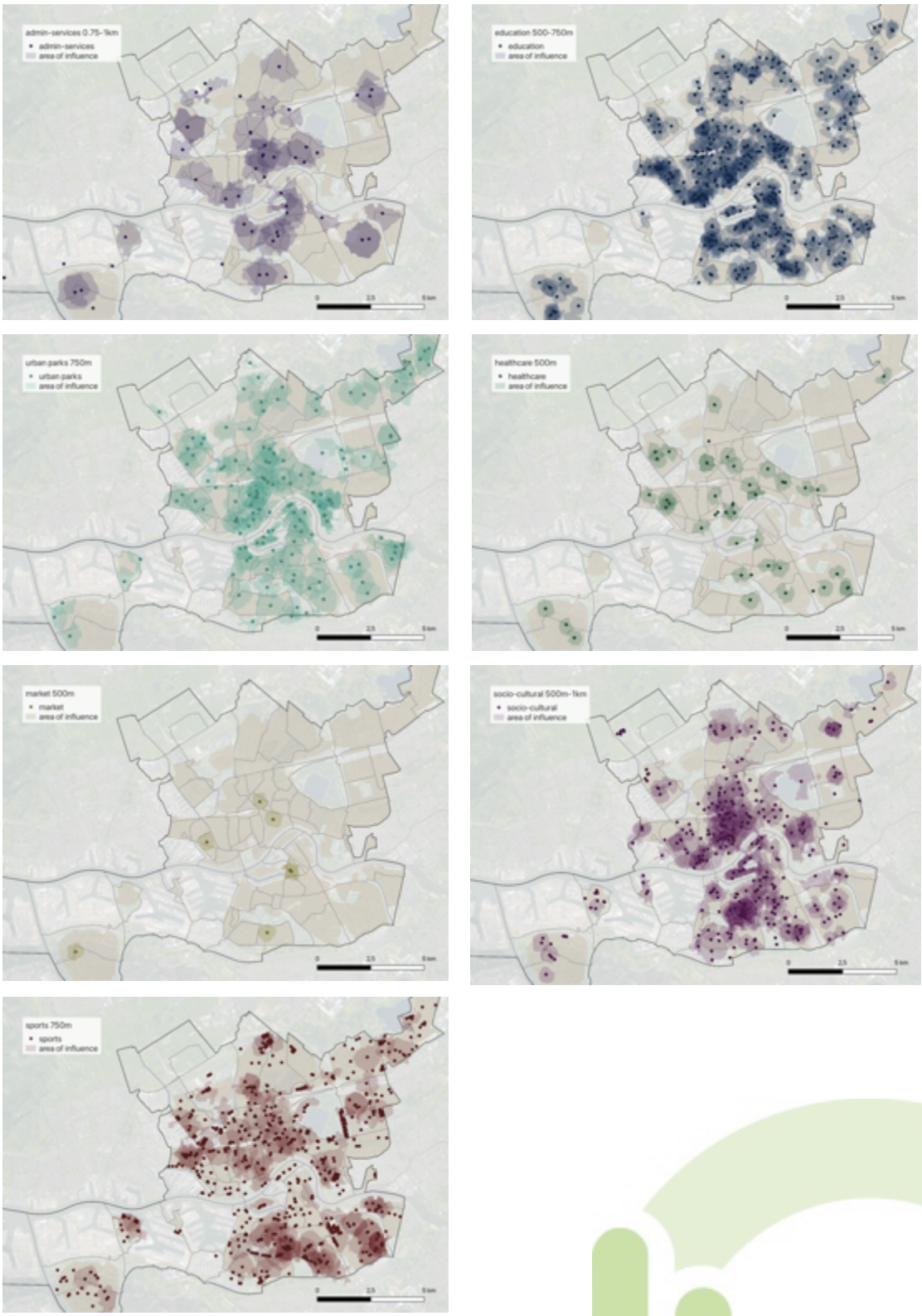

2.b.i. Number of points of interest accessible within [radio of influence] m (per facility, service)

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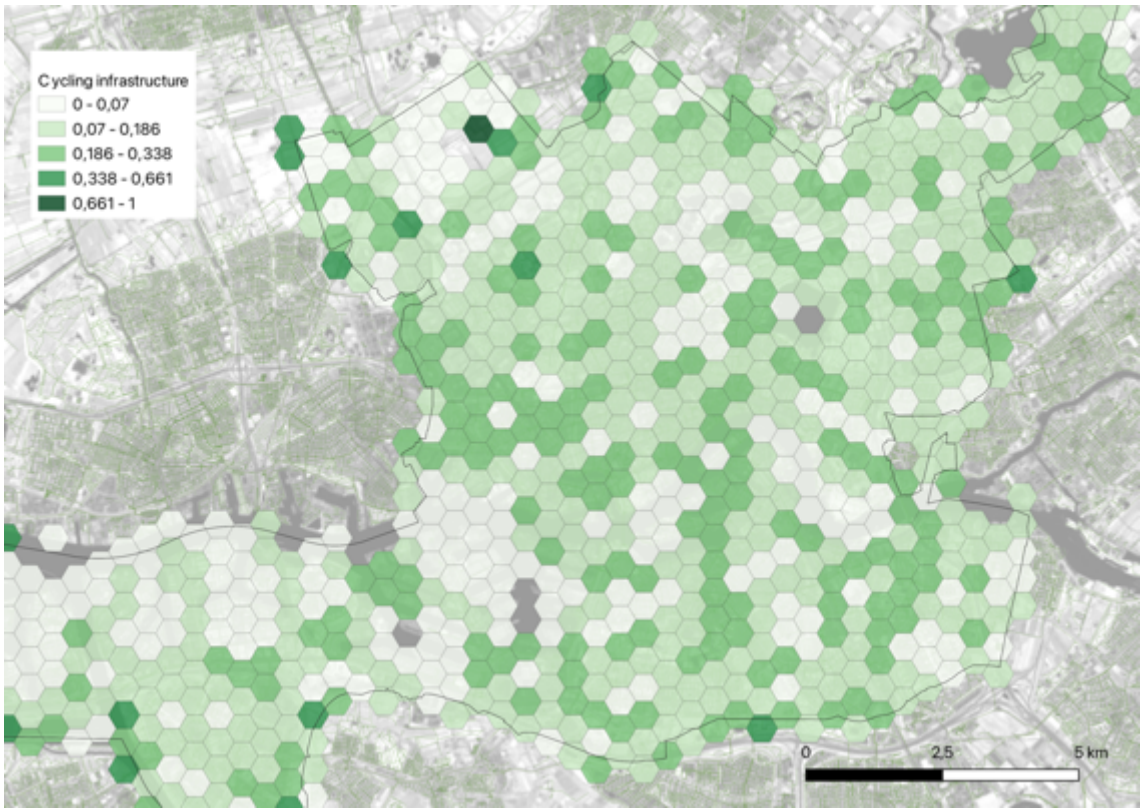
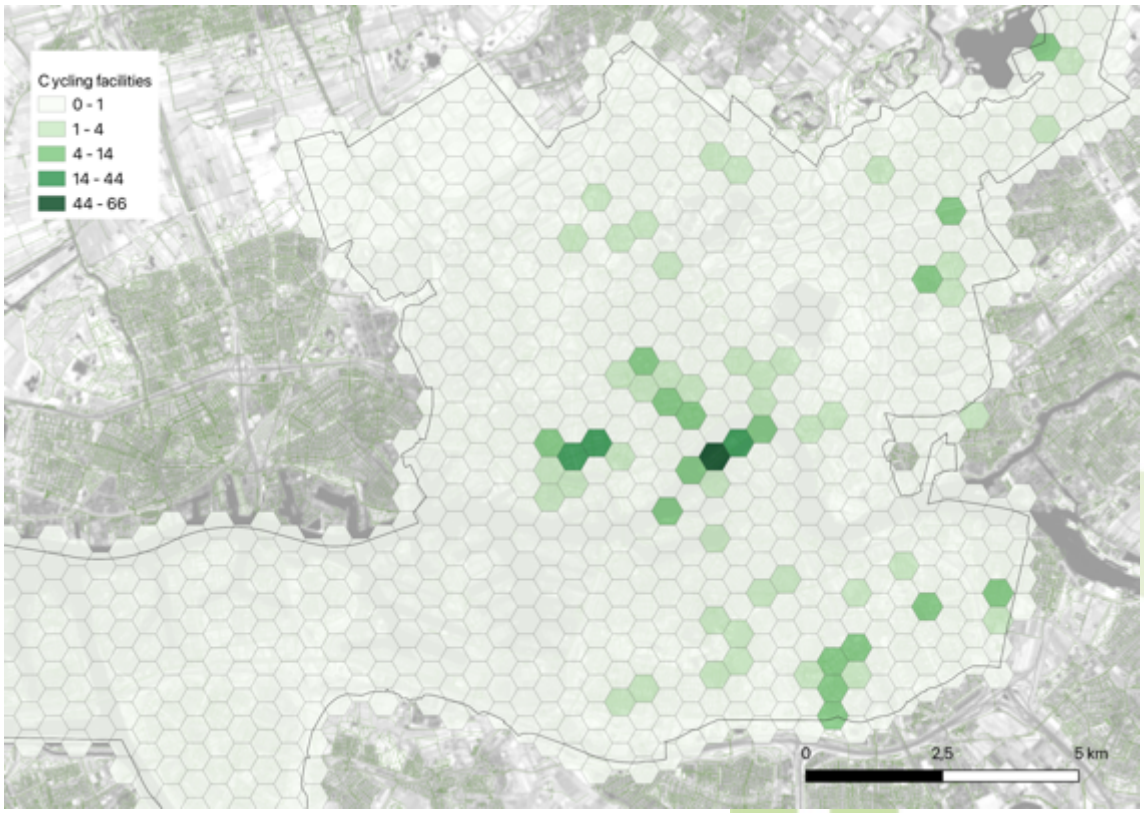


2.c.i. % of streets with cycle infrastructure (0 low - 1 high)



2.c.ii. Number of bicycle stations or parking facilities within 500m

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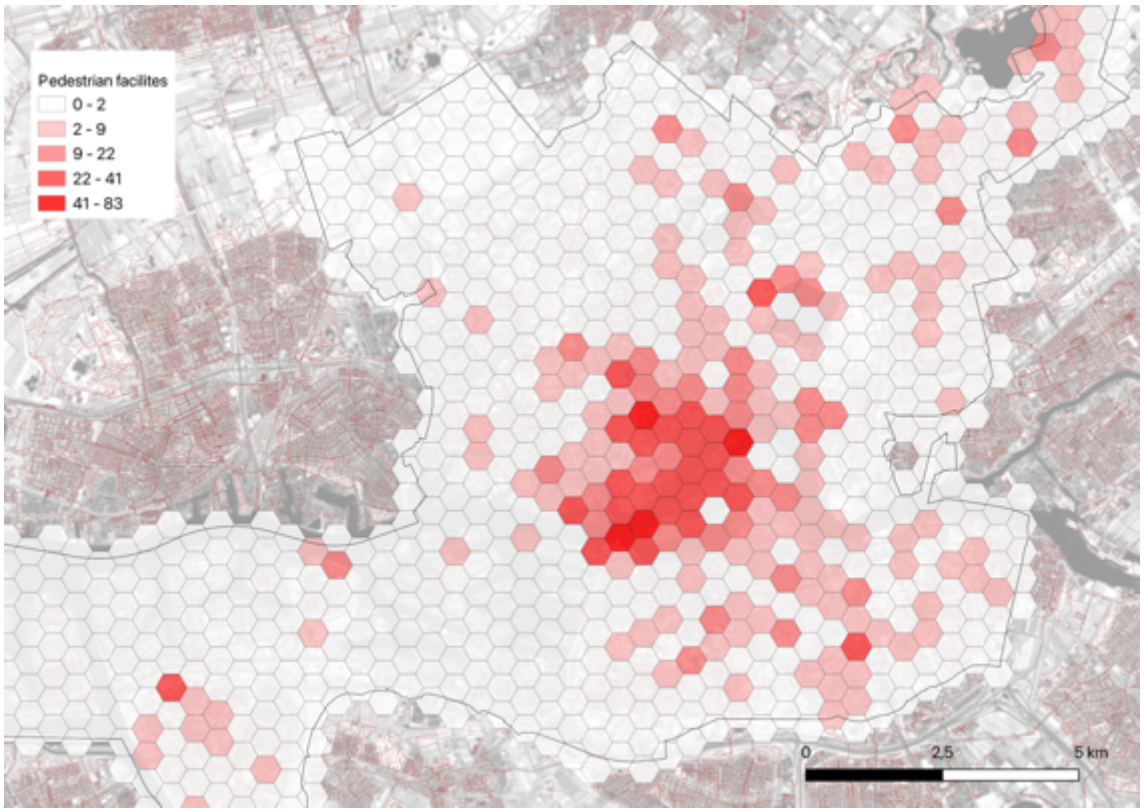
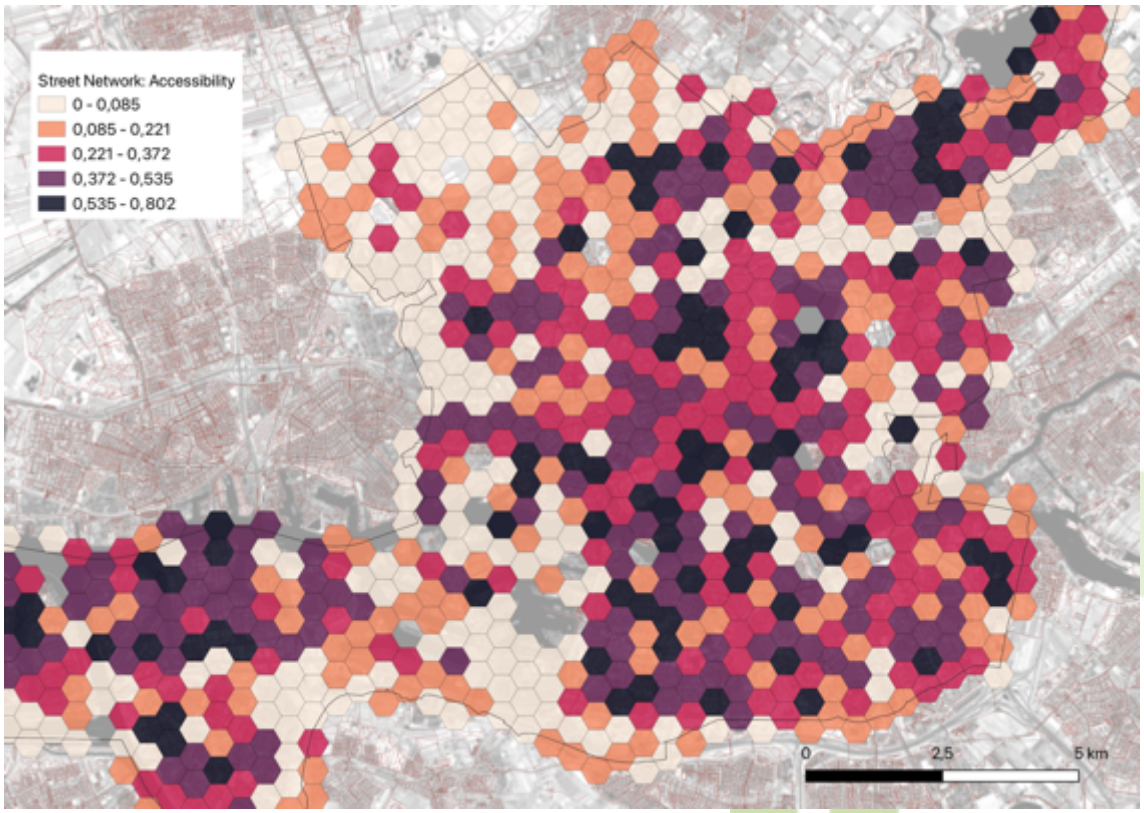


2.d.i. Number of pedestrian facilities



2.d.iii Accessibility (relation of areas accessible within the cycling and pedestrian network, 0 low - 1 high)

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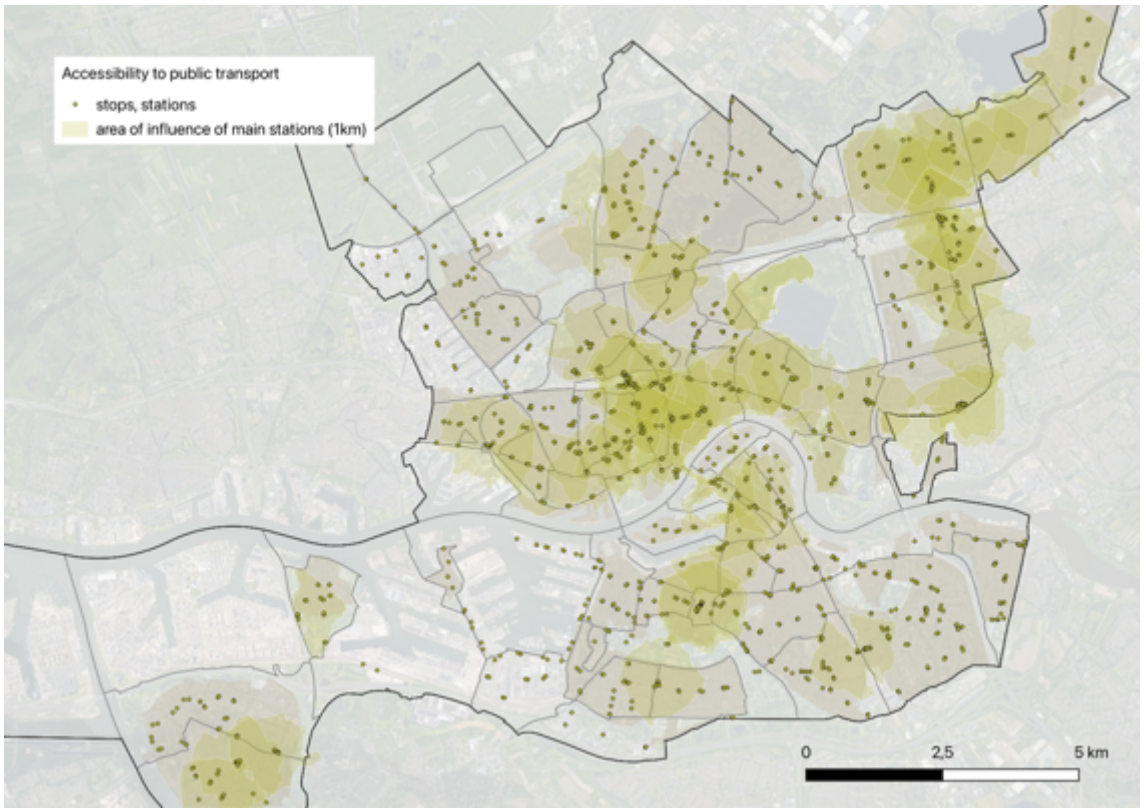
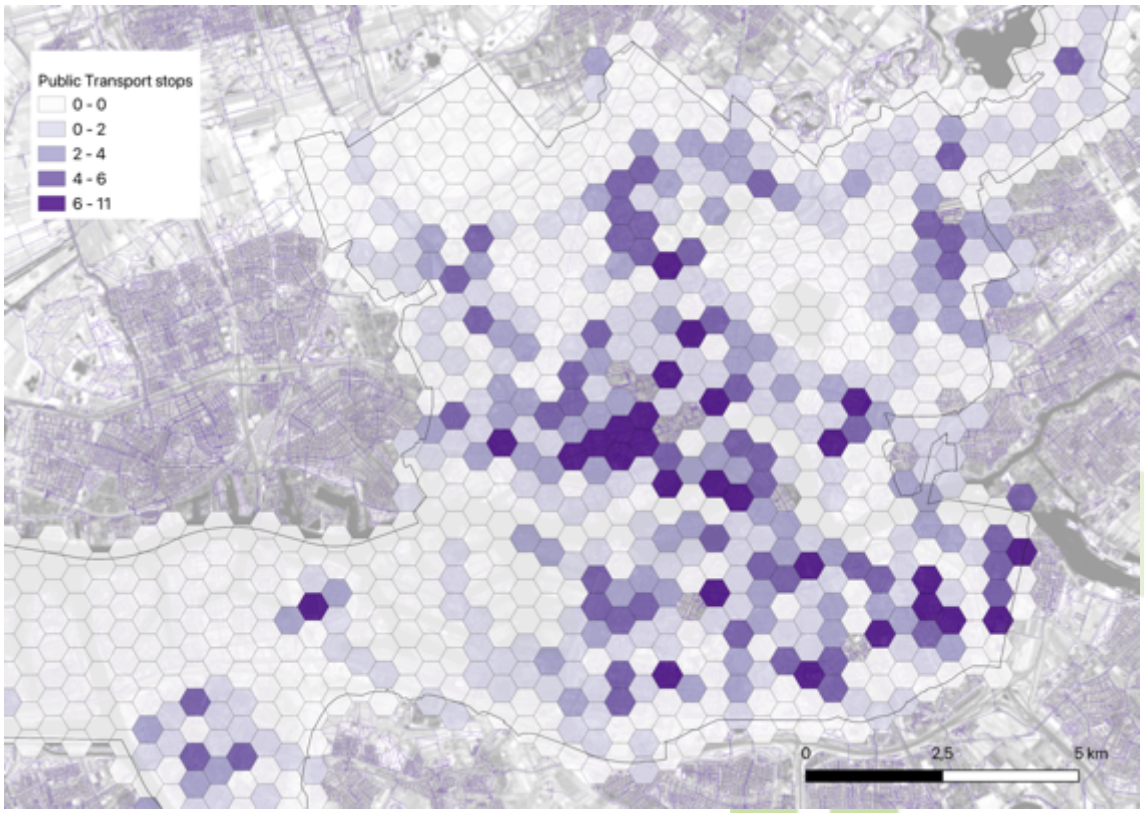


2.e.i Stations accessible within 1km



2.e.ii. Availability of stops-stations within 500m (number of stops and stations per cell)

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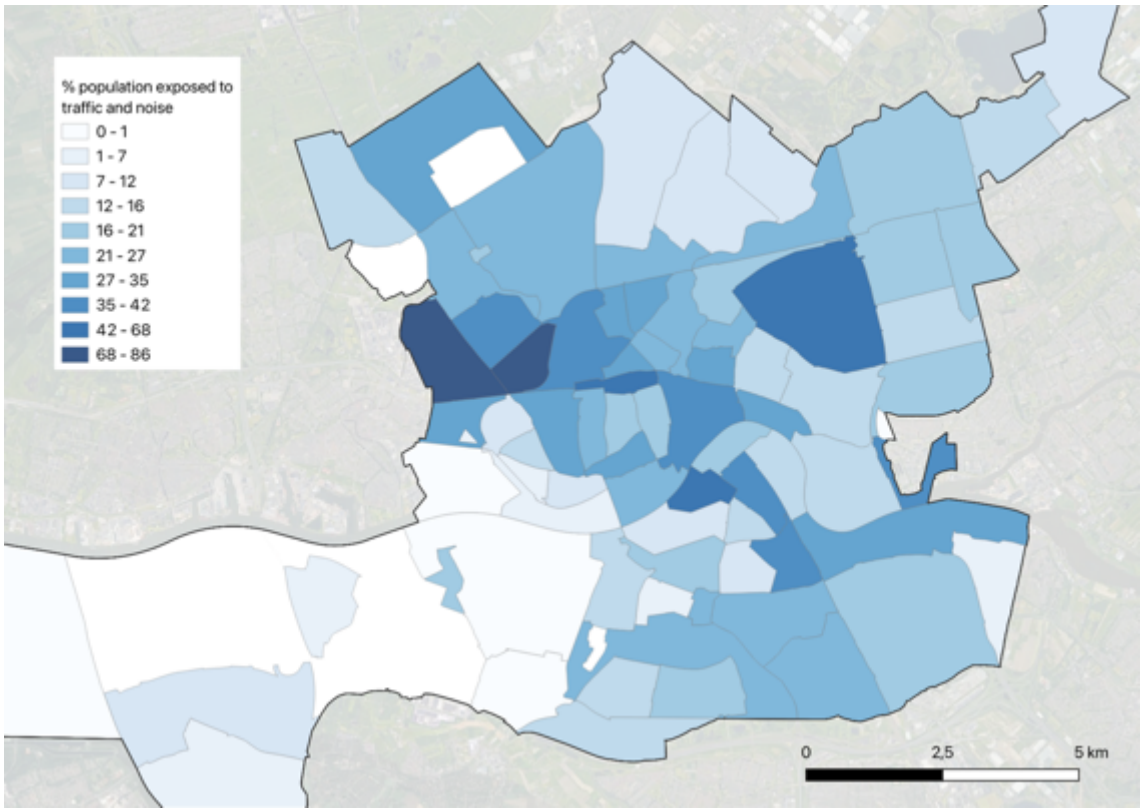
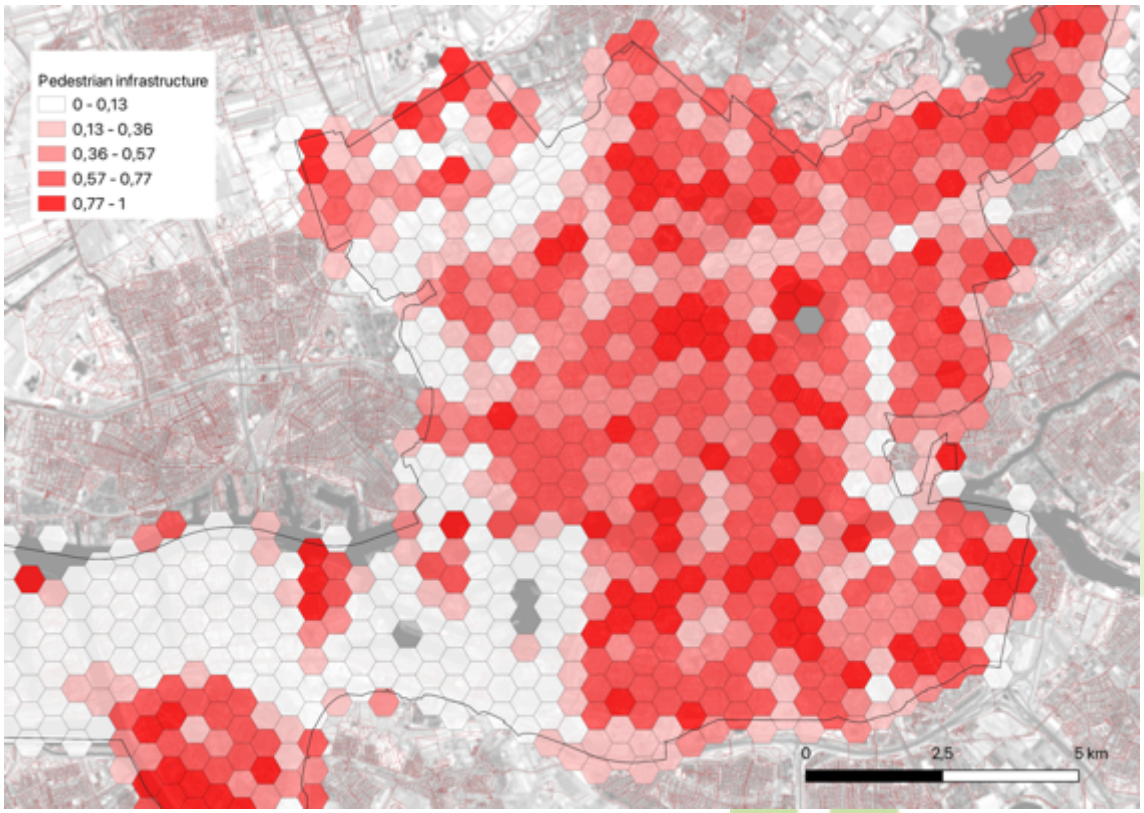


2.f.i % of inhabitants exposed to traffic (and noise exposure)



2.f.ii % of area where motorised traffic is not permitted or restricted

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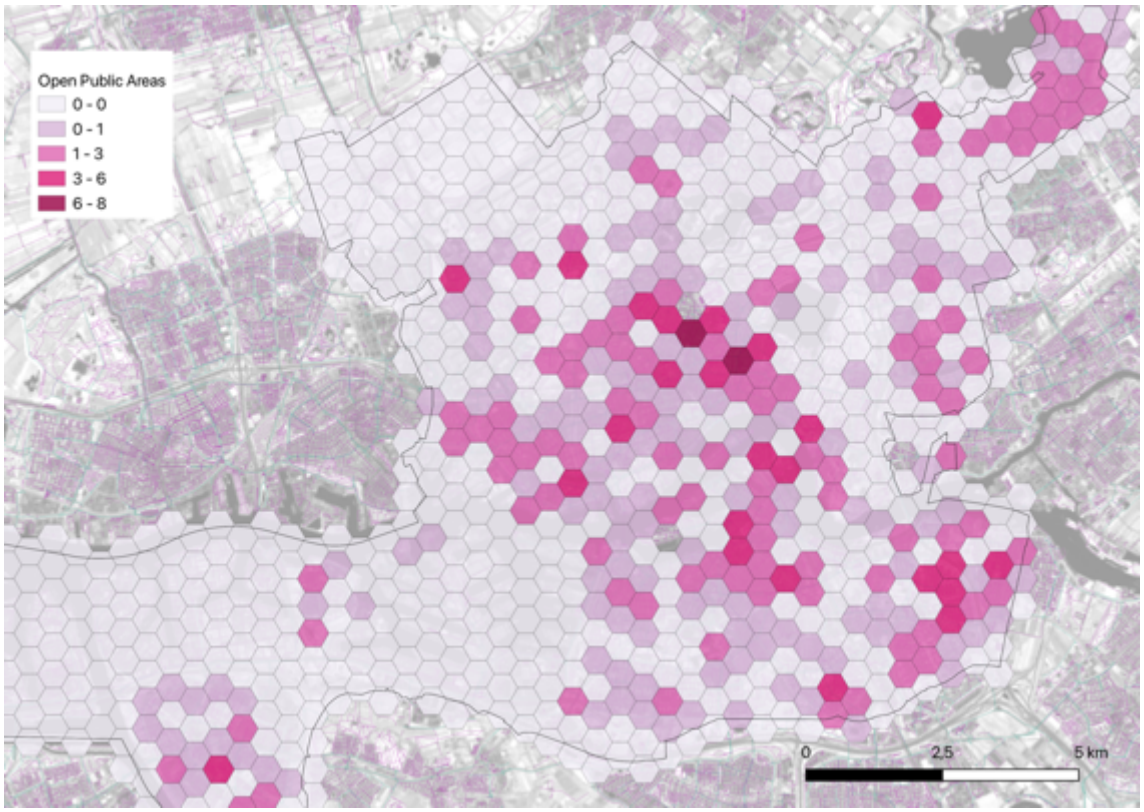
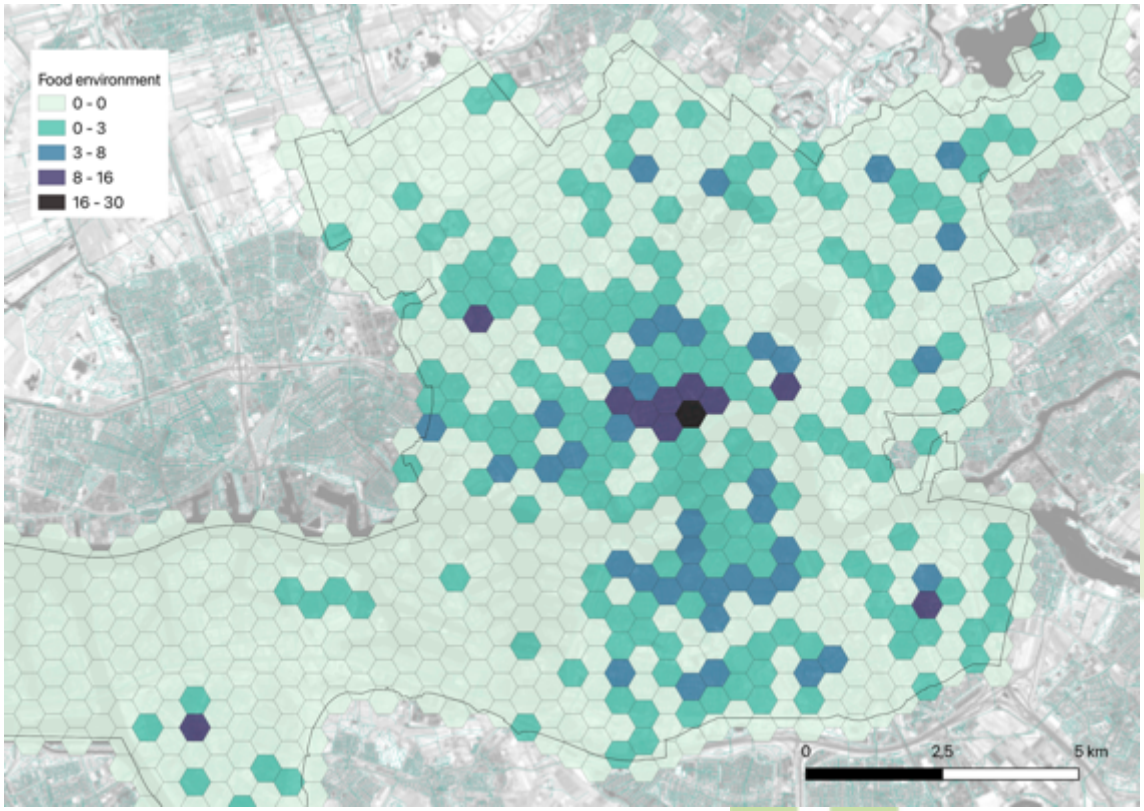


3.a. Number of open public spaces within 500m



3.b. Number of food related (fresh-food and grocery shops, urban agriculture, allotment areas) services within 500m

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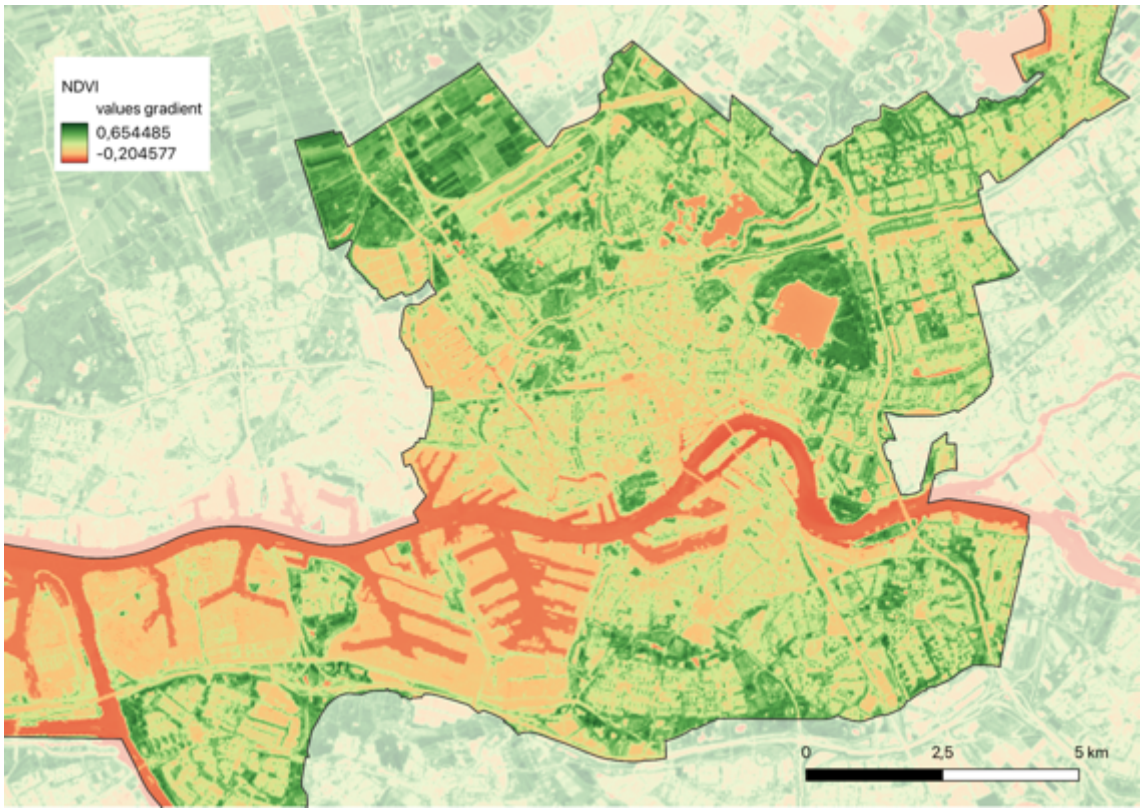

4.a.i. Normalised difference vegetation index (NDVI)

4.a.ii Surface area of green space per inhabitant

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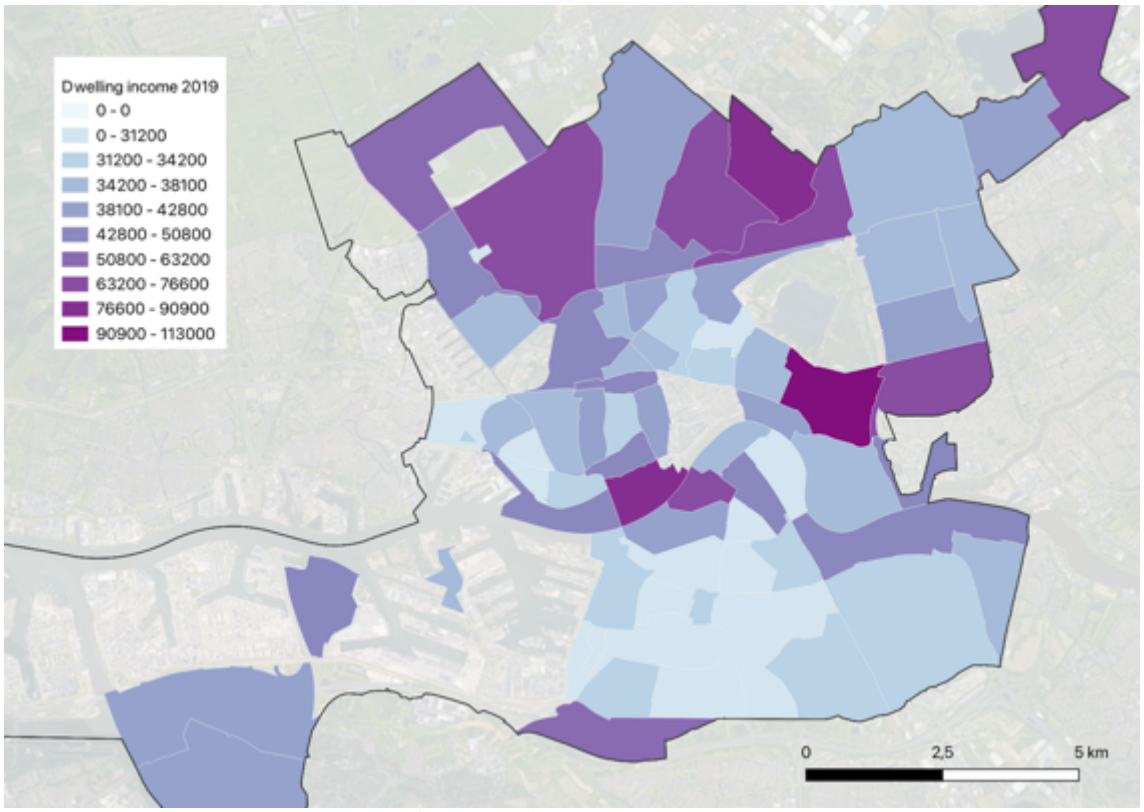
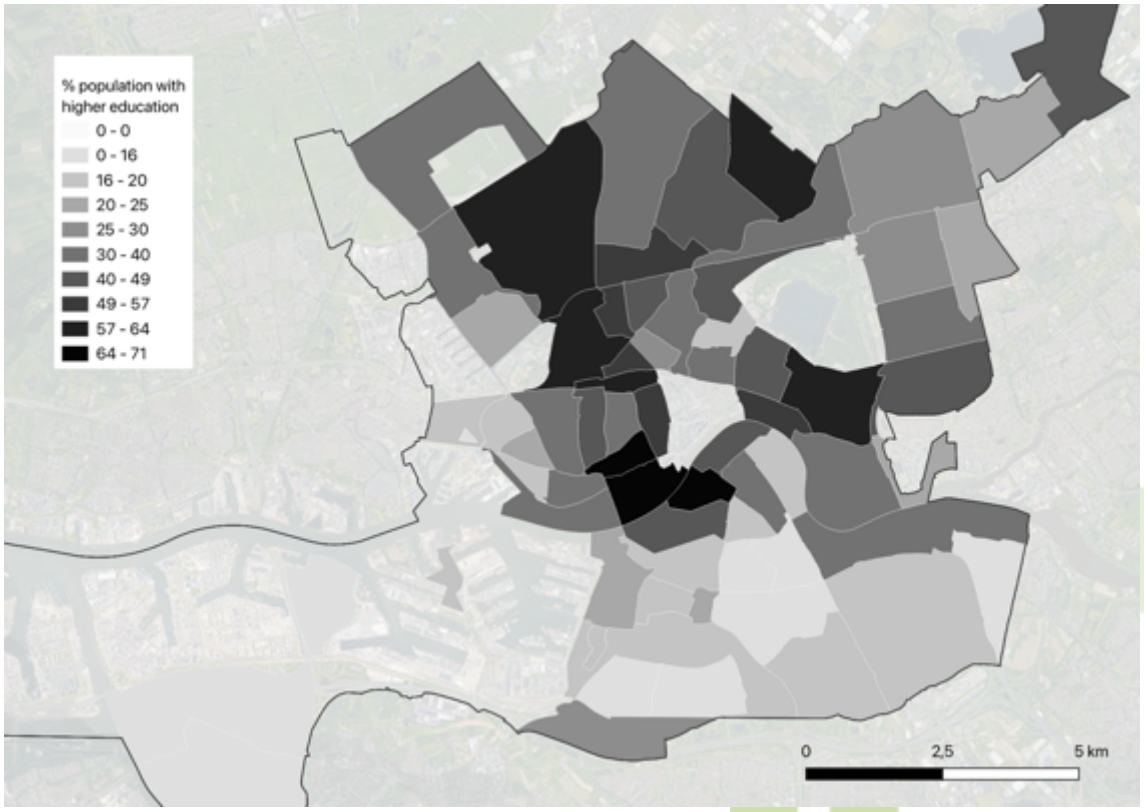


5.a. Average income per dwelling 2019 (euros/year)



5.b. Percentage of population with higher education 2020

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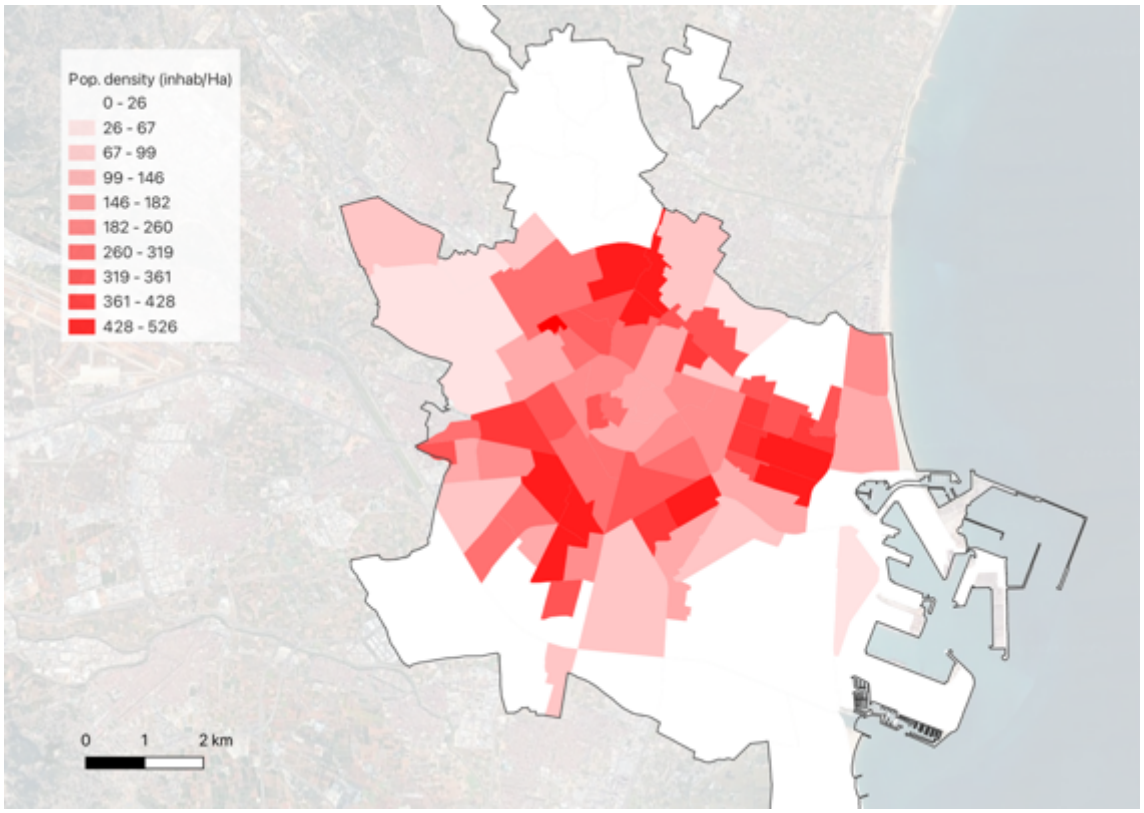
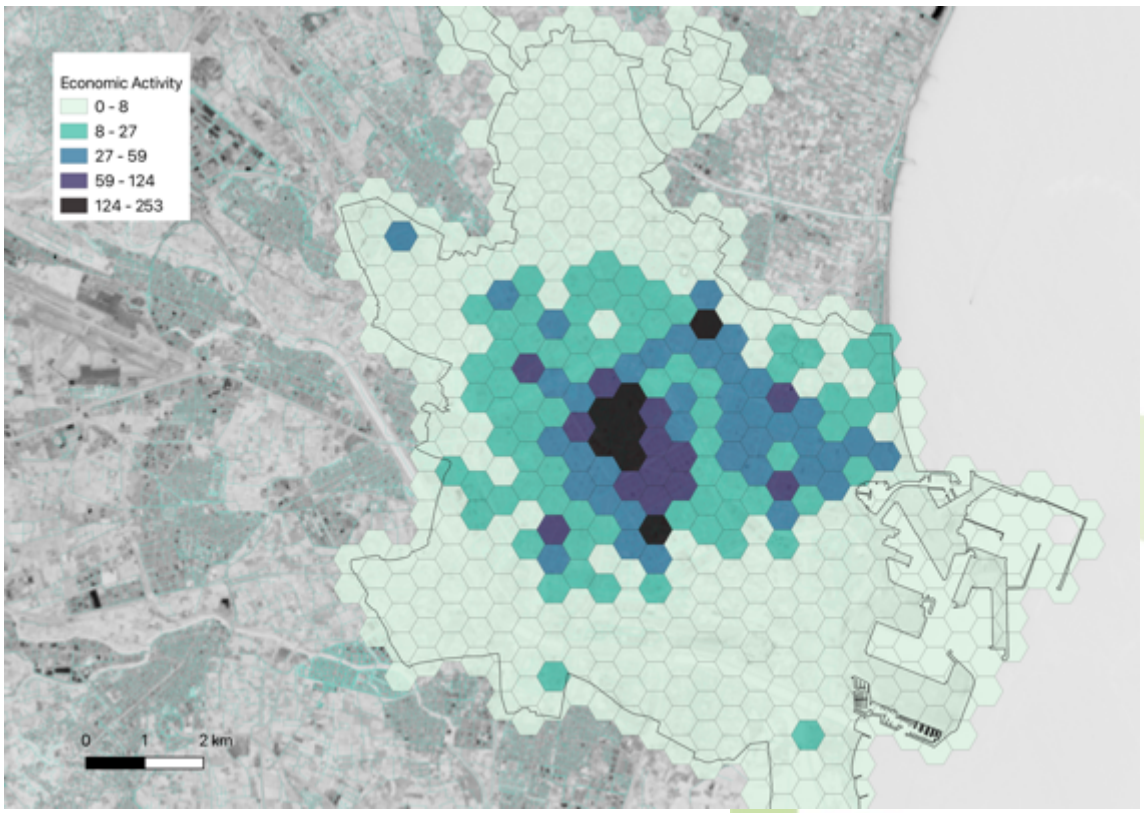
Valencia



1.a. Net population density



1.b. Economic activity (number of shops, business)

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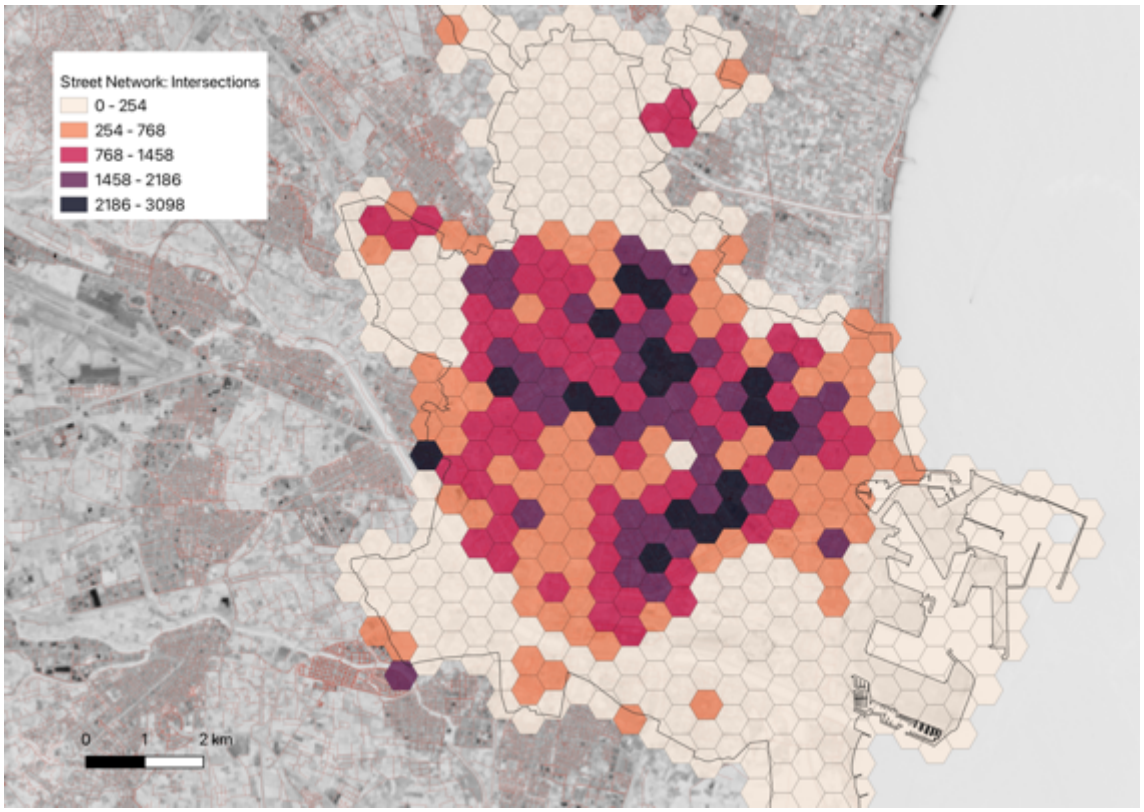
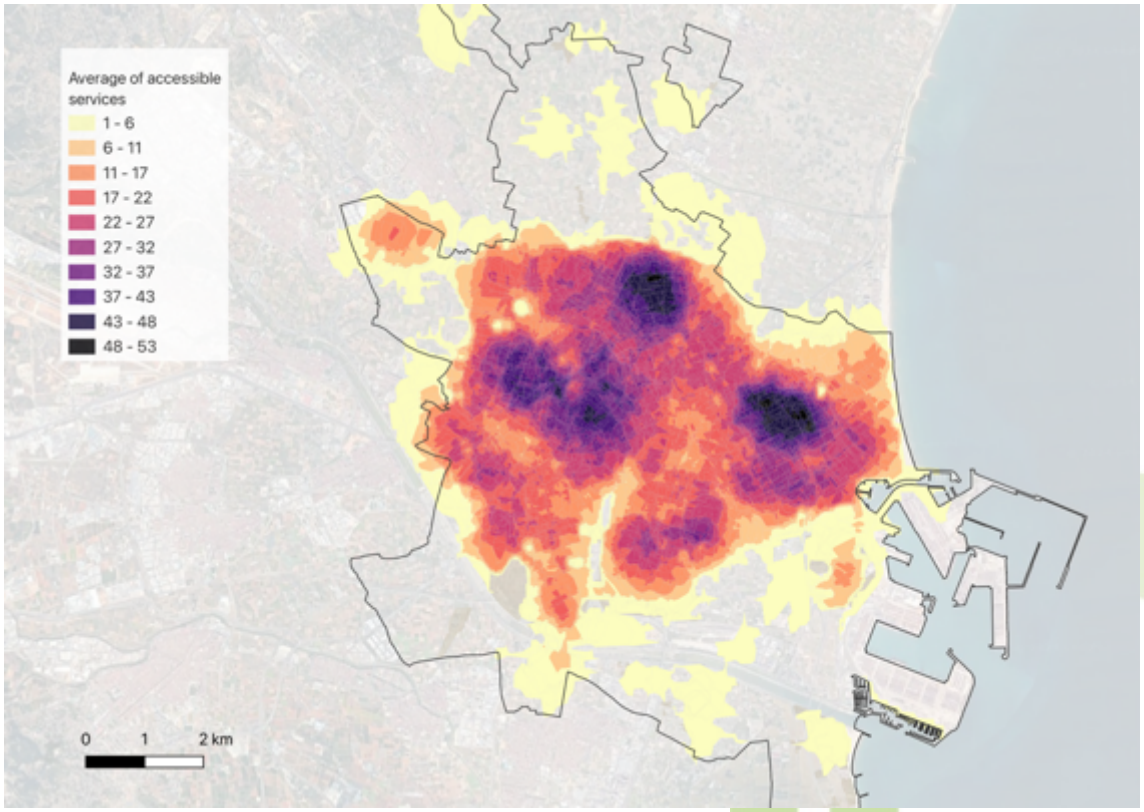


2.a. Number of intersections with 3 or more streets per km²/Ha



2.b.ii. Global connectivity to services

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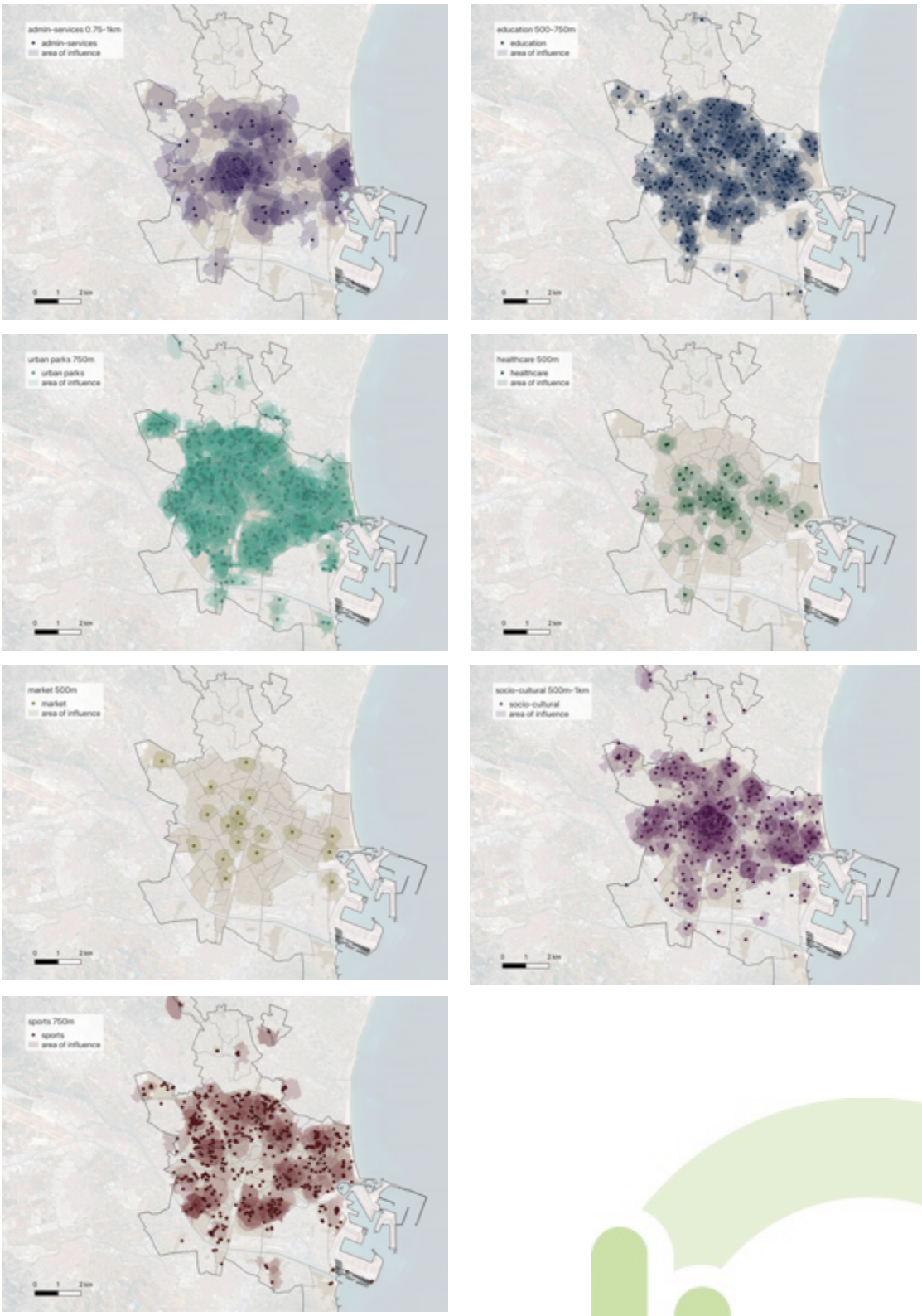

2.b.i. Number of points of interest accessible within [radio of influence] m (per facility, service)

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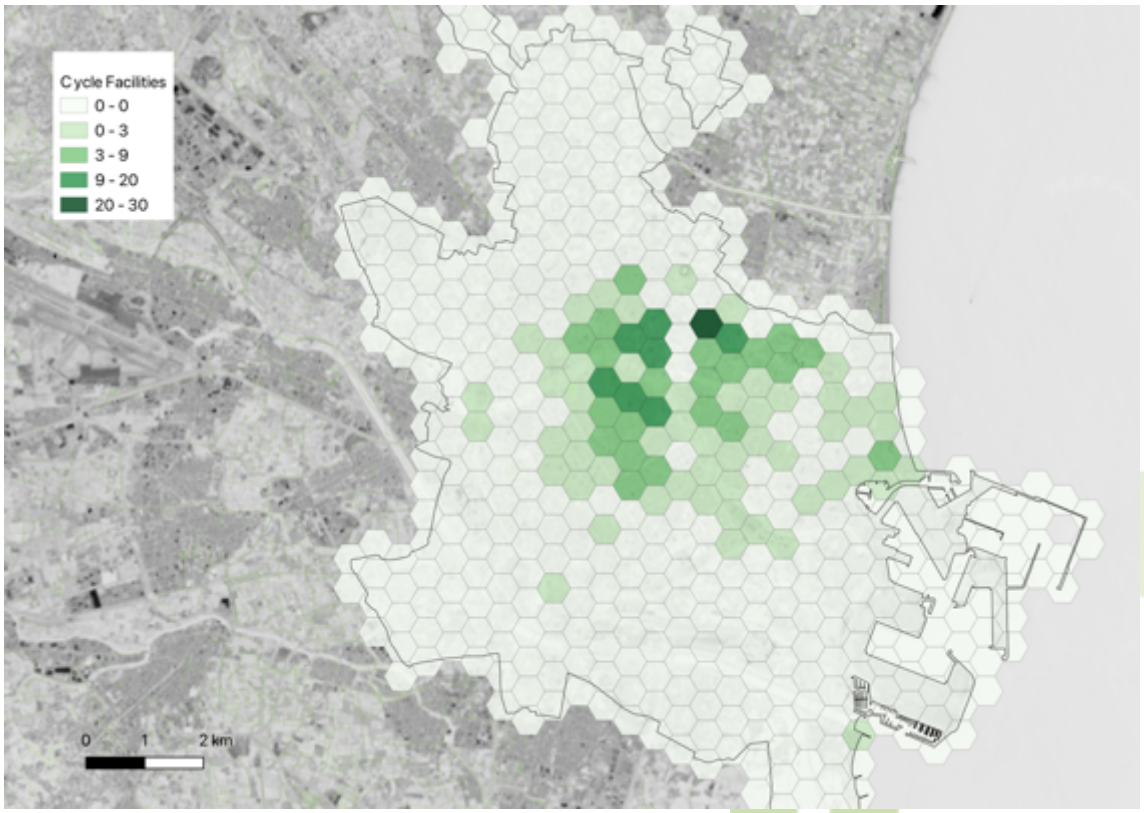
2.c.i. % of streets with cycle infrastructure (0 low - 1 high)



2.c.ii. Number of bicycle stations or parking facilities within 500m

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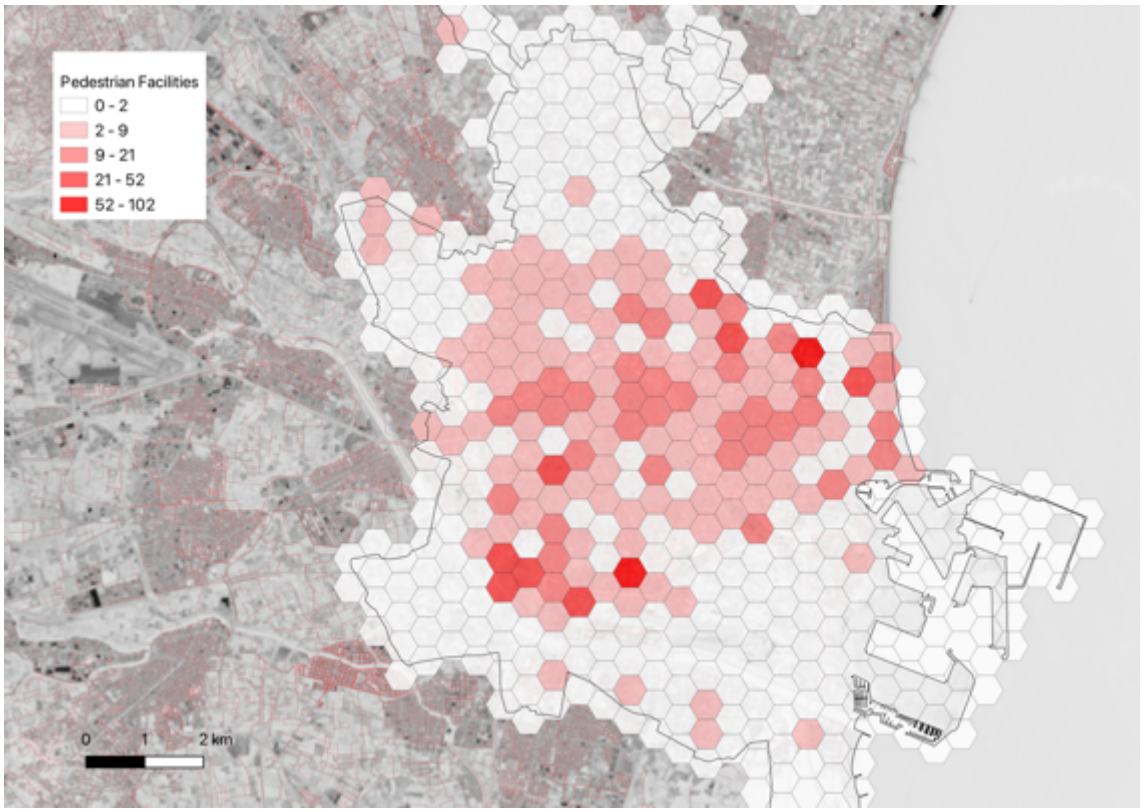
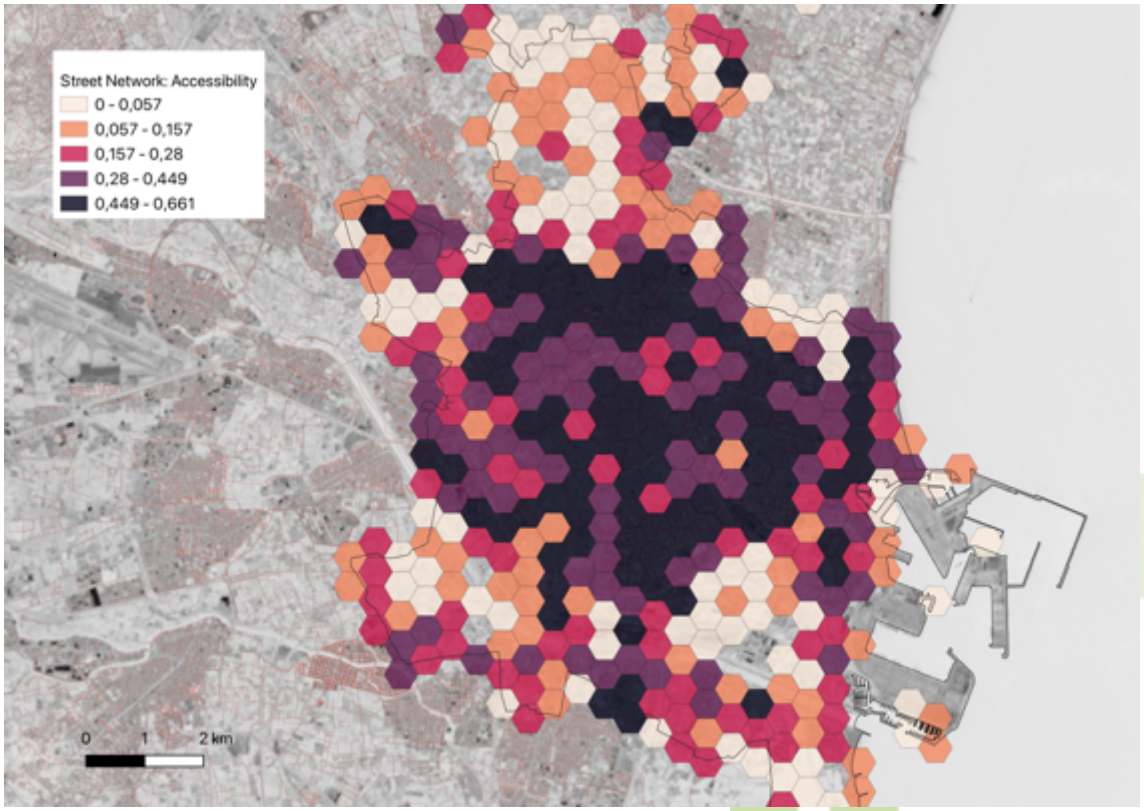


2.d.i. Number of pedestrian facilities



2.d.iii Accessibility (relation of areas accessible within the cycling and pedestrian network, 0 low - 1 high)

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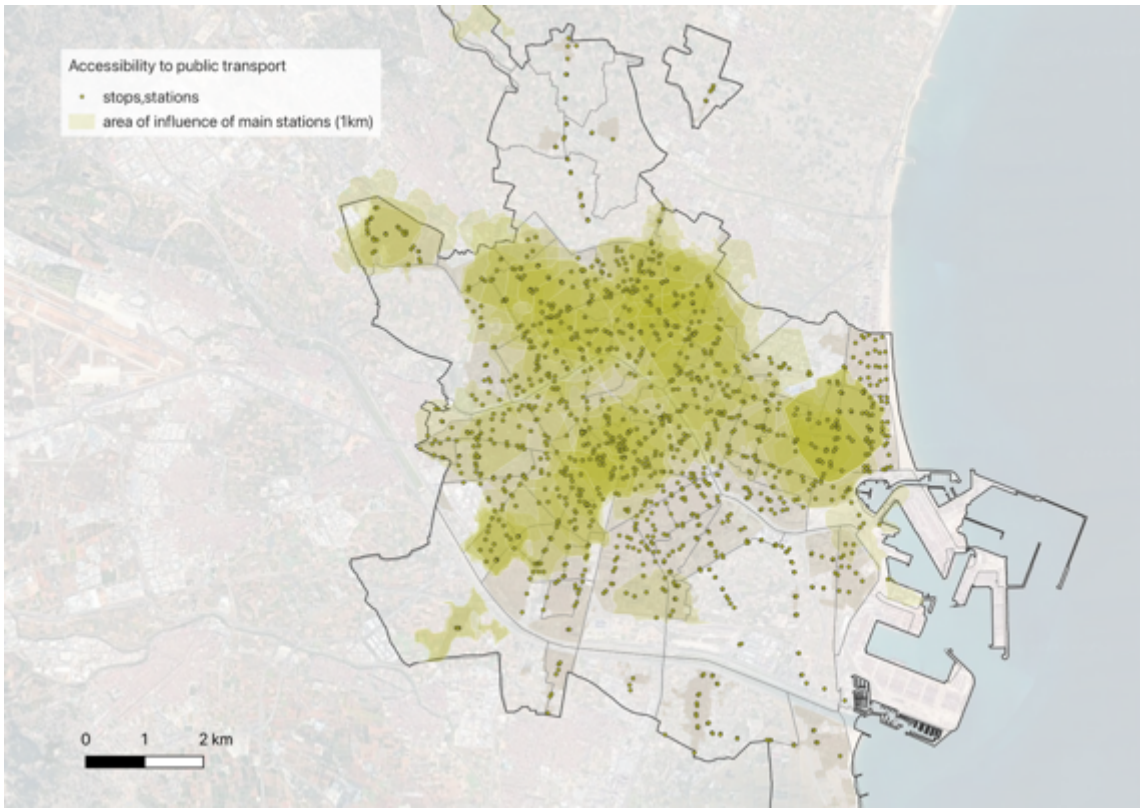
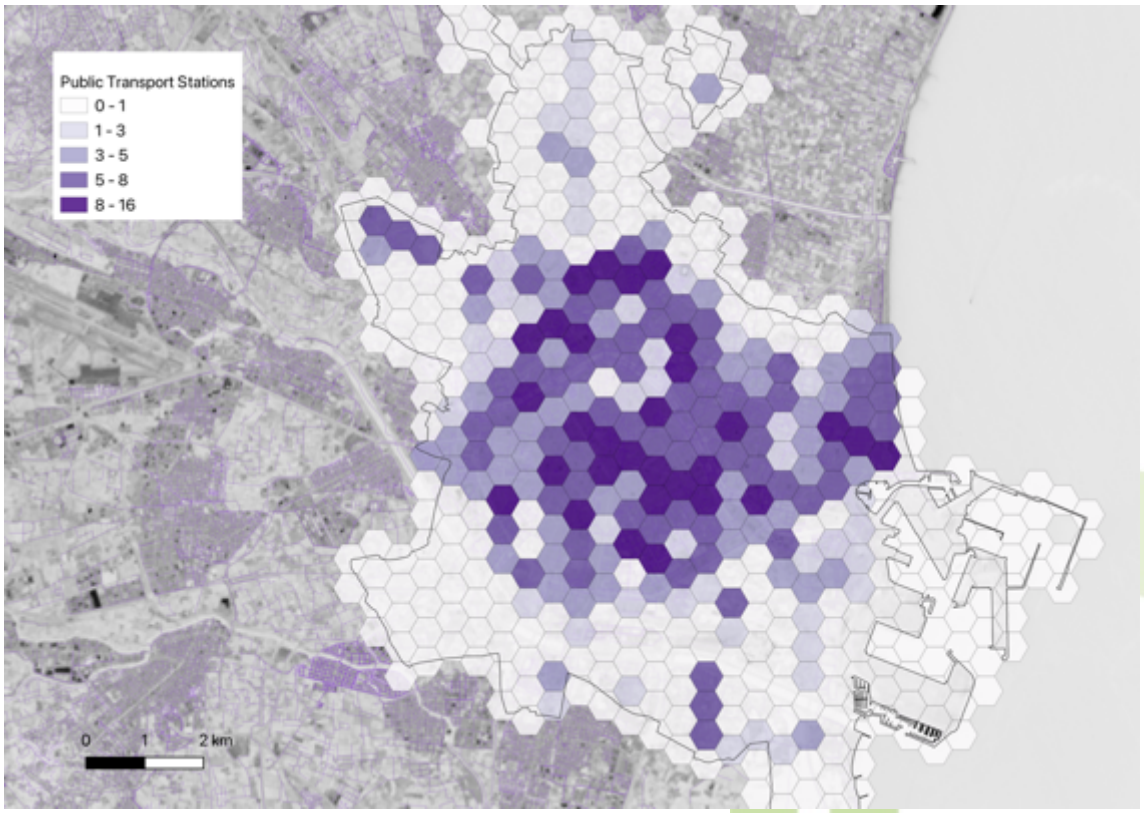


2.e.i Stations accessible within 1km



2.e.ii. Availability of stops-stations within 500m (number of stops and stations per cell)

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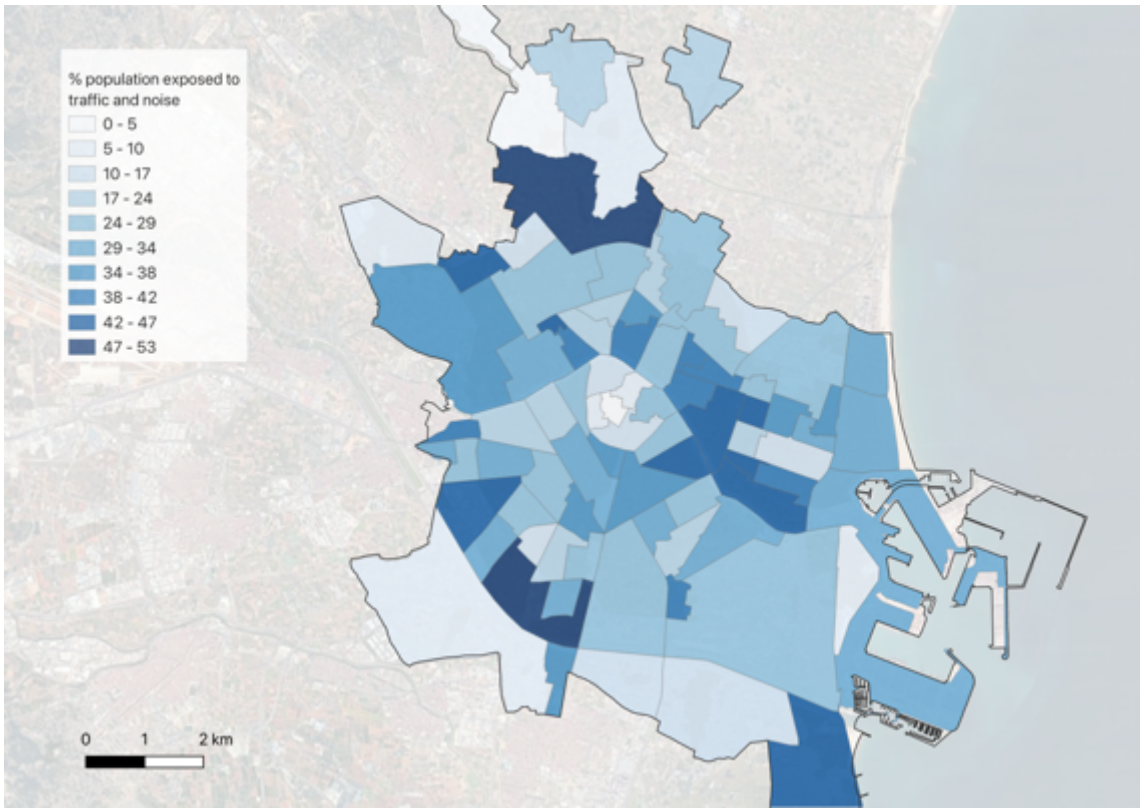
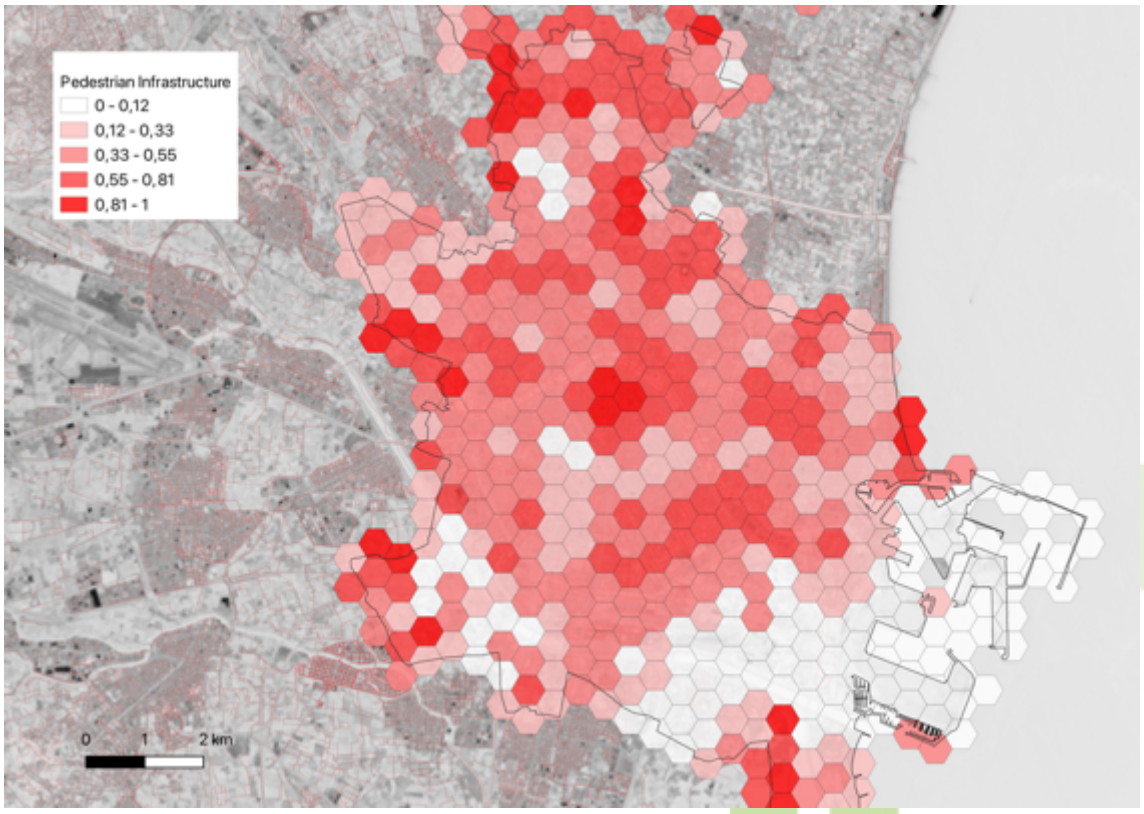


2.f.i % of inhabitants exposed to traffic (and noise exposure)



2.f.ii % of area where motorised traffic is not permitted or is restricted

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3.a. Number of open public spaces within 500m

3.b. Number of food related (fresh-food and grocery shops, urban agriculture, allotment areas) services within 500m

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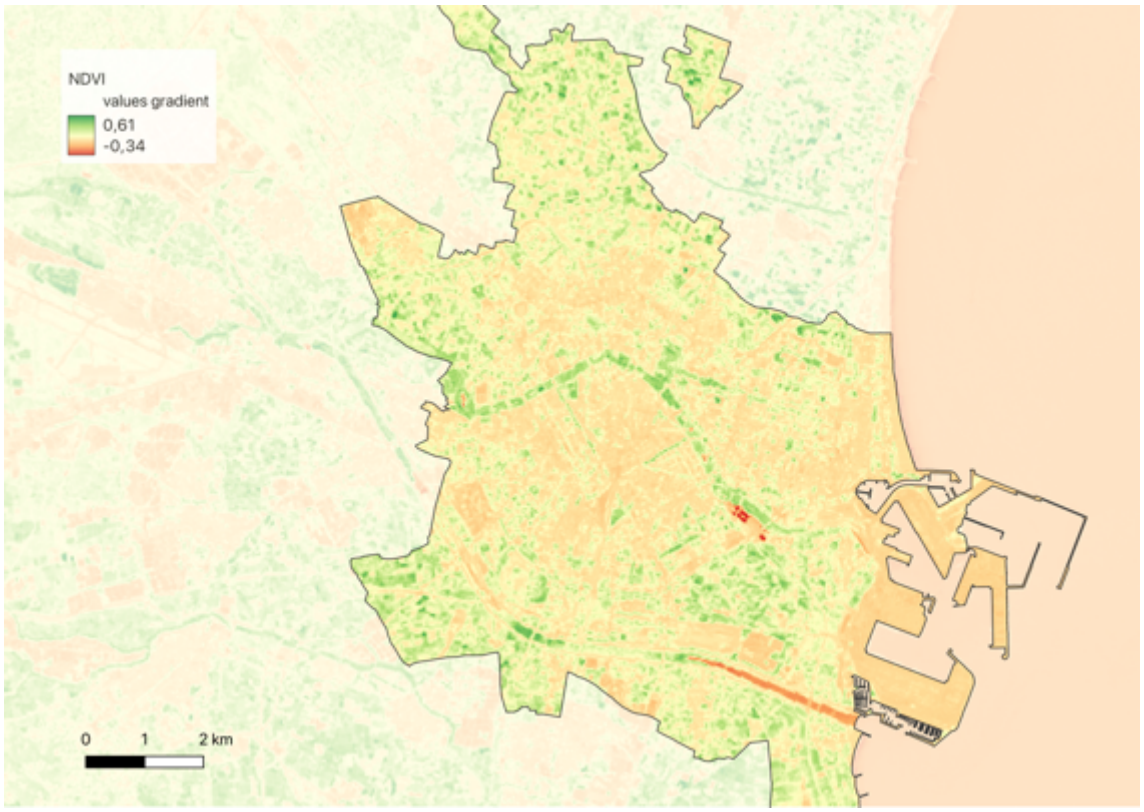
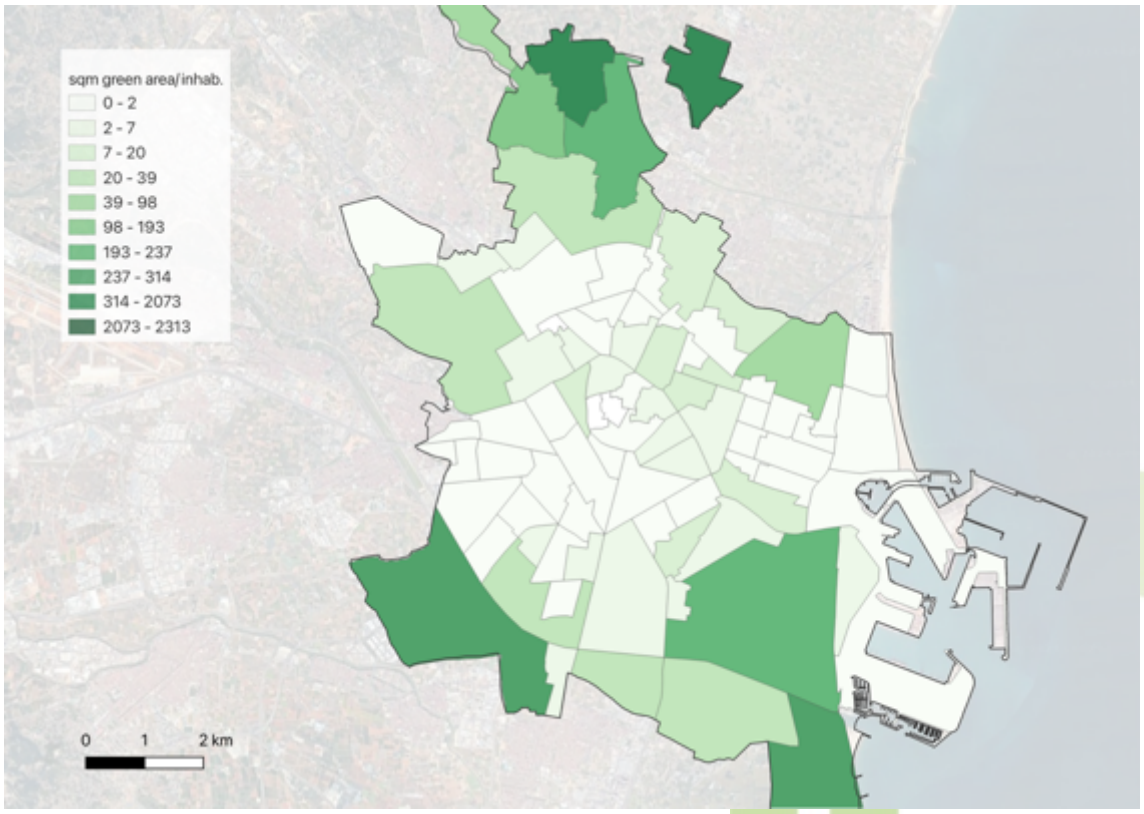


4.a.i. Normalised difference vegetation index (NDVI)



4.a.ii Surface area of green space per inhabitant

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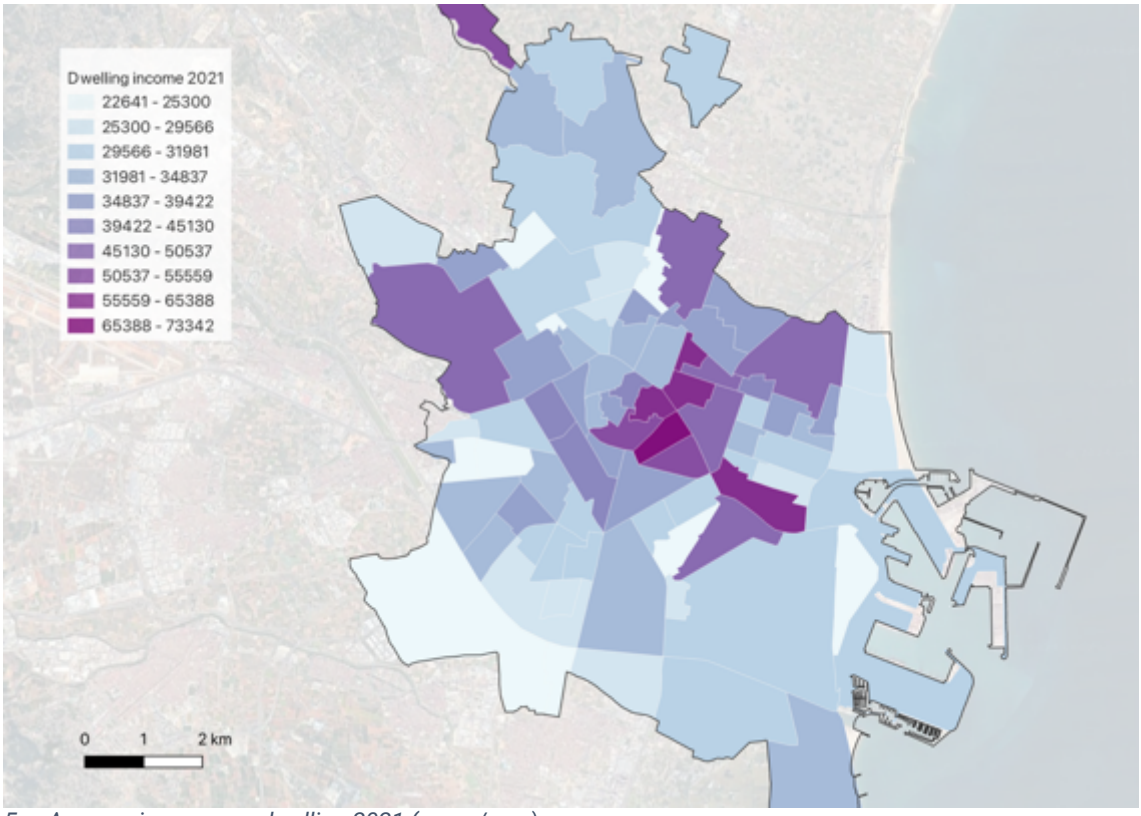
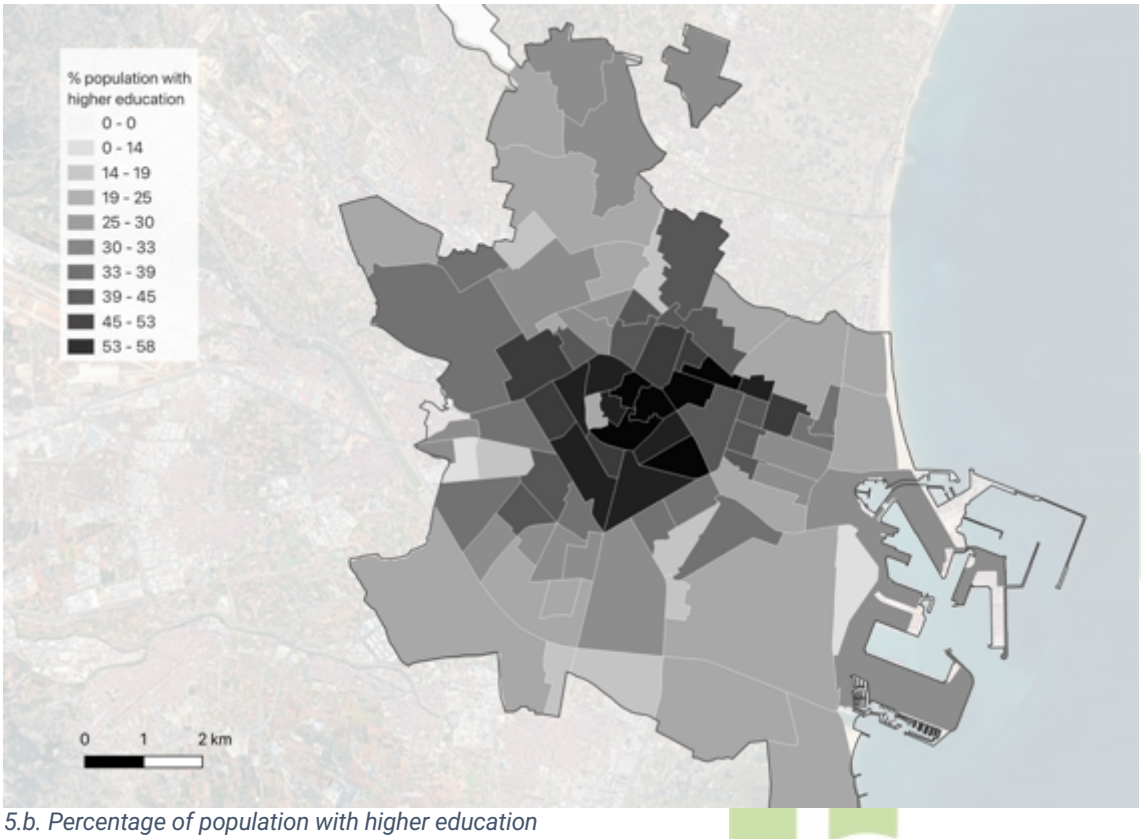
SOCIOECONOMIC ANALYSIS



5.a. Average income per dwelling 2021 (euros/year)



5.b. Percentage of population with higher education

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Prevalence of risk behaviours and NCD incidence

Variables analysed:

Rijeka

No data was available at the time of submitting the current deliverable, as MEDRI is currently collecting the data as part of Task 2.1. Once data is available, the thematic maps will be updated to include these variables for Rijeka.

Rotterdam

1. Alcohol consumption
2. Smoking habits
3. Overweight
4. Moderately intense exercise
5. Practise of sport
6. Population with diagnosed diabetes
7. Stroke and/or brain haemorrhage and/or brain infarct
8. Heart infarct or disease
9. High blood pressure
10. Cardial arrythmia
11. Dietary habits - fast food 1-3 days/week
12. Dietary habits - fast food 5 days/week
13. Dietary habits - fast food 7 days/week
14. Dietary habits - sugary drinks
15. Drugs consumption

Valencia

1. Perception of the importance of sport
2. Population commuting to daily activities
3. Time dedicated to exercise
4. Sleeping time
5. NCD risk associated with dietary pattern
6. Smoking habits
7. Alcohol consumption
8. Overweight
9. Population with diagnosed diabetes
10. Population with diagnosed CVD

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Rotterdam

1. Alcohol consumption

2. Smoking habits

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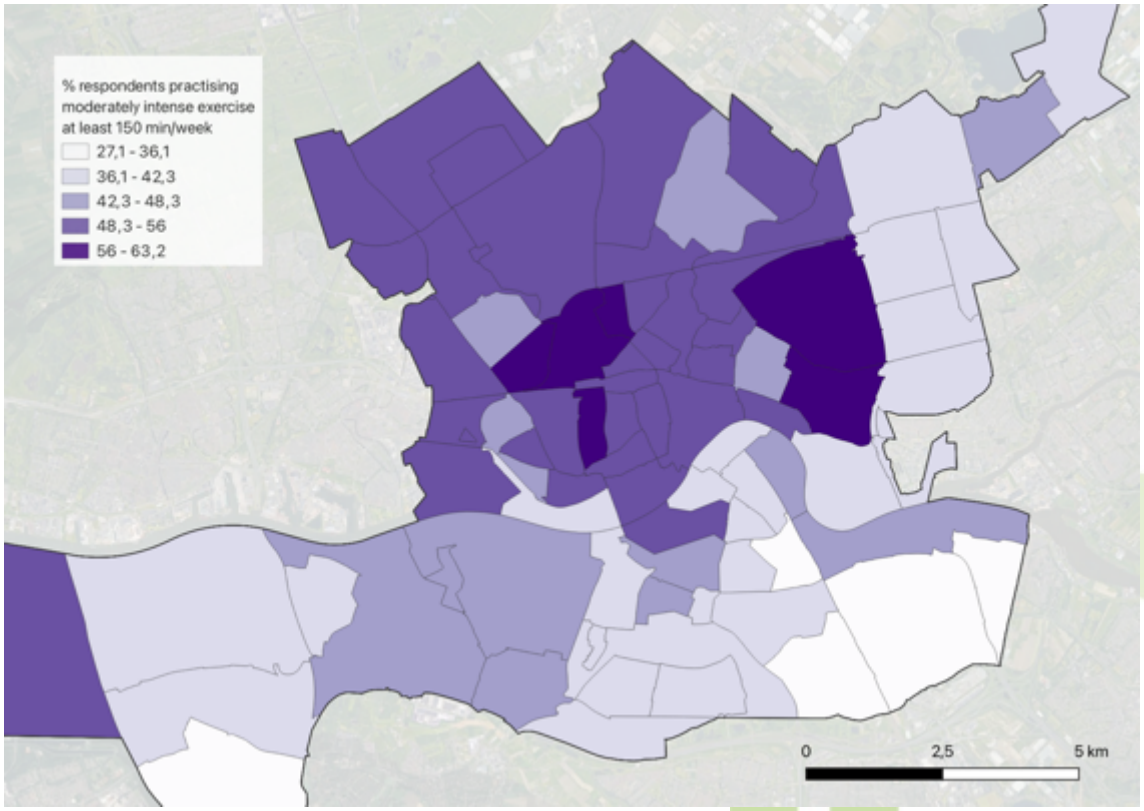
3. Overweight



4. Moderately intense exercise

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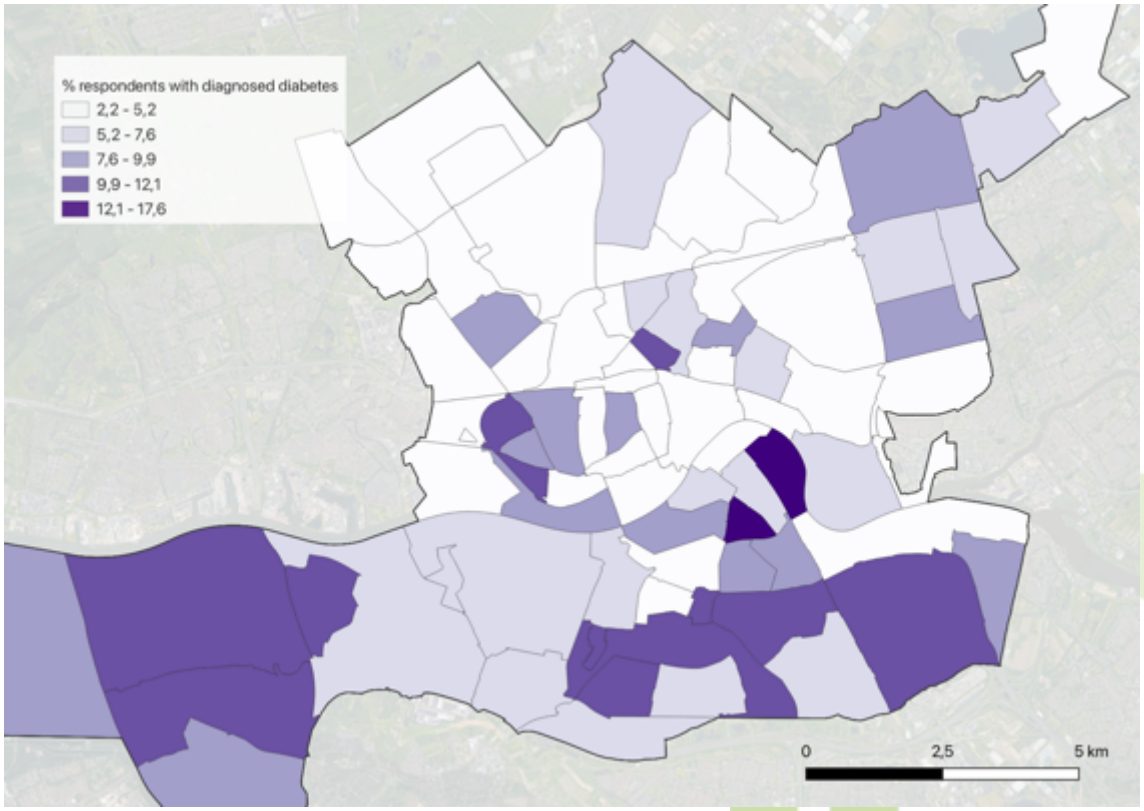
5. Practice of sport



6. Population with diagnosed diabetes (diagnosed by physician)

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7. Stroke and/or brain haemorrhage and/or brain infarct (diagnosed by physician)

8. Heart infarct or disease (diagnosed by physician)

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9. High blood pressure (hypertension) (diagnosed by physician)

10. Cardial arrythmia (diagnosed by physician)

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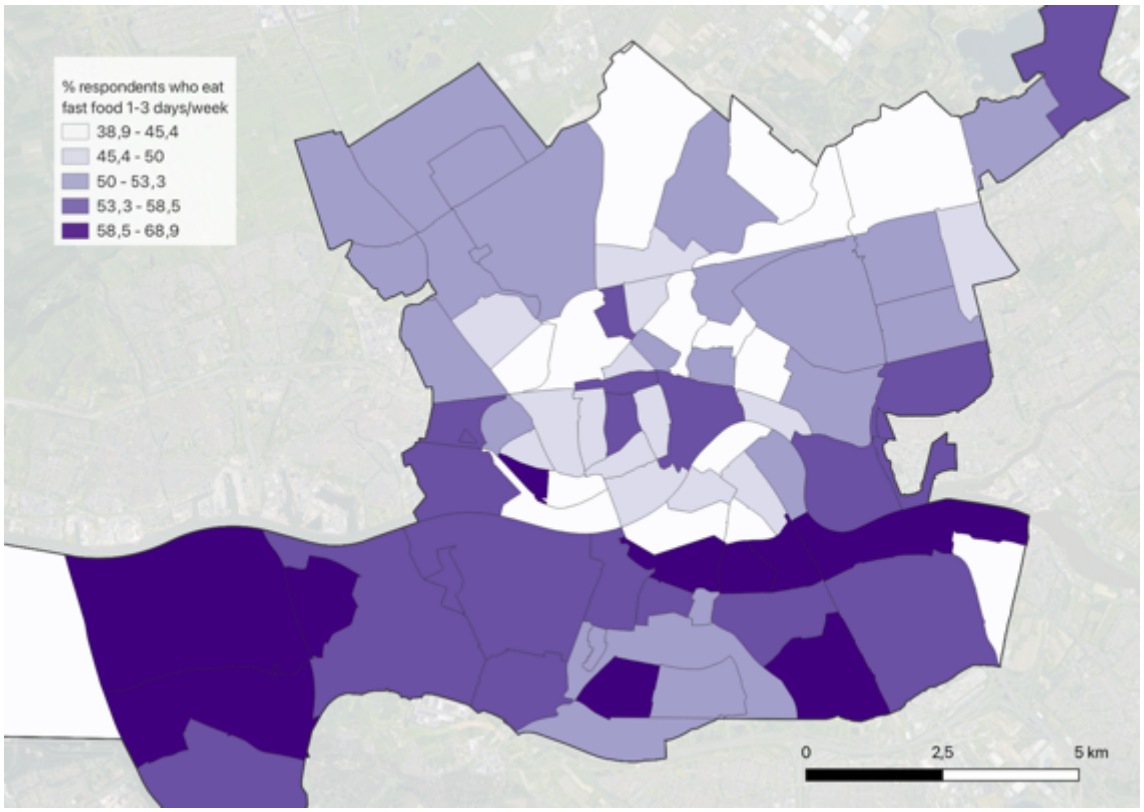

11. Dietary habits - fast food 1-3 days/week

12. Dietary habits - fast food 5 days/week

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13. Dietary habits - fast food 7 days/week

14. Dietary habits - consumption of sugary drinks

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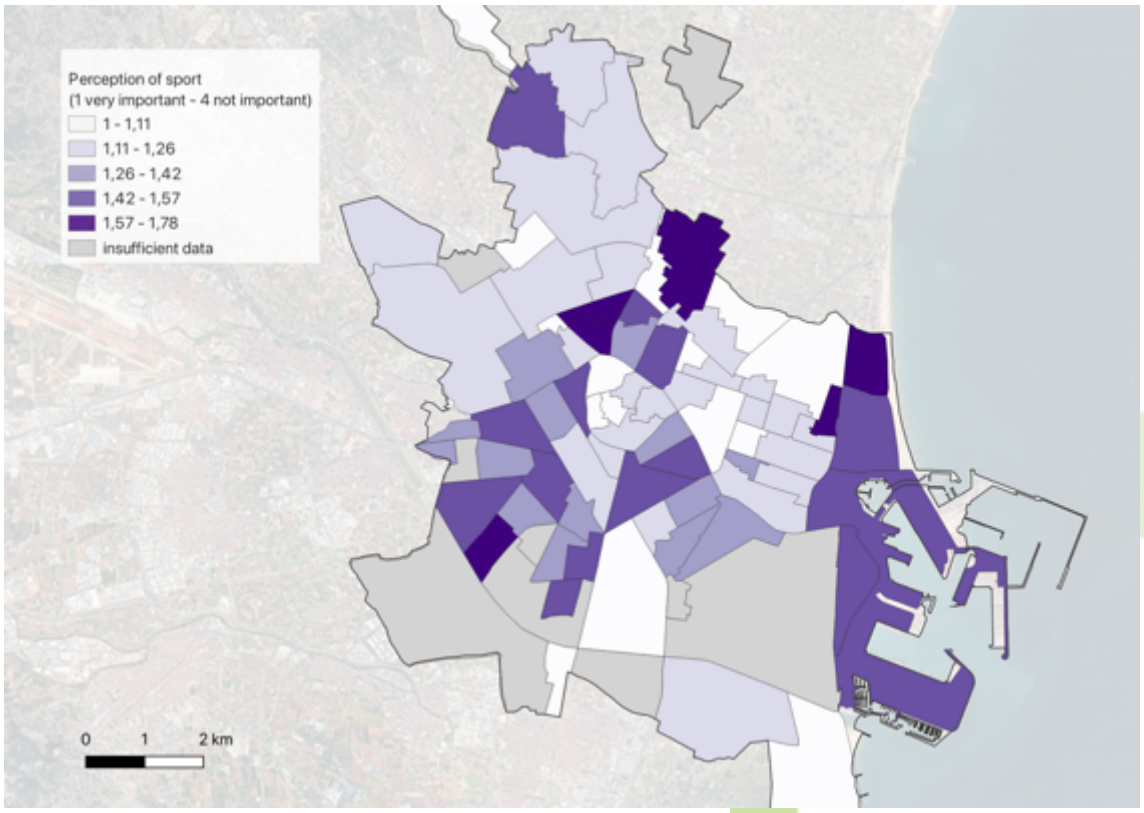
15. Drugs consumption

Valencia



1. Perception of the importance of sport

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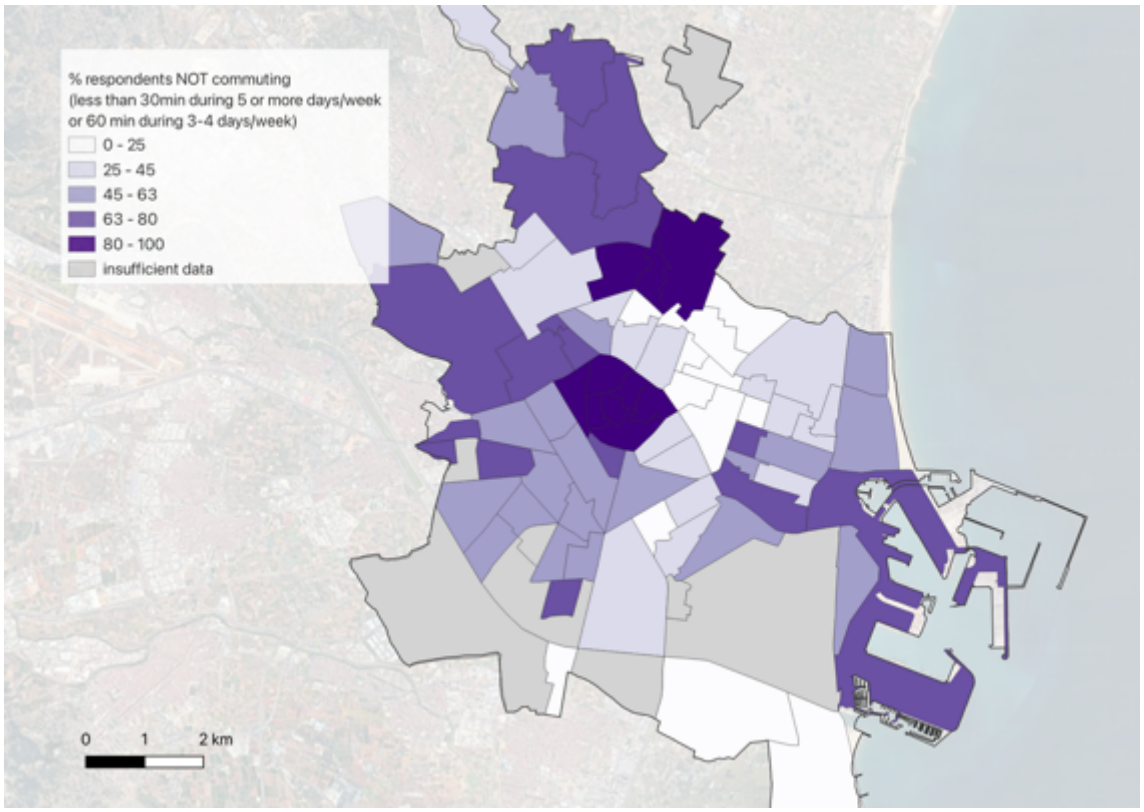
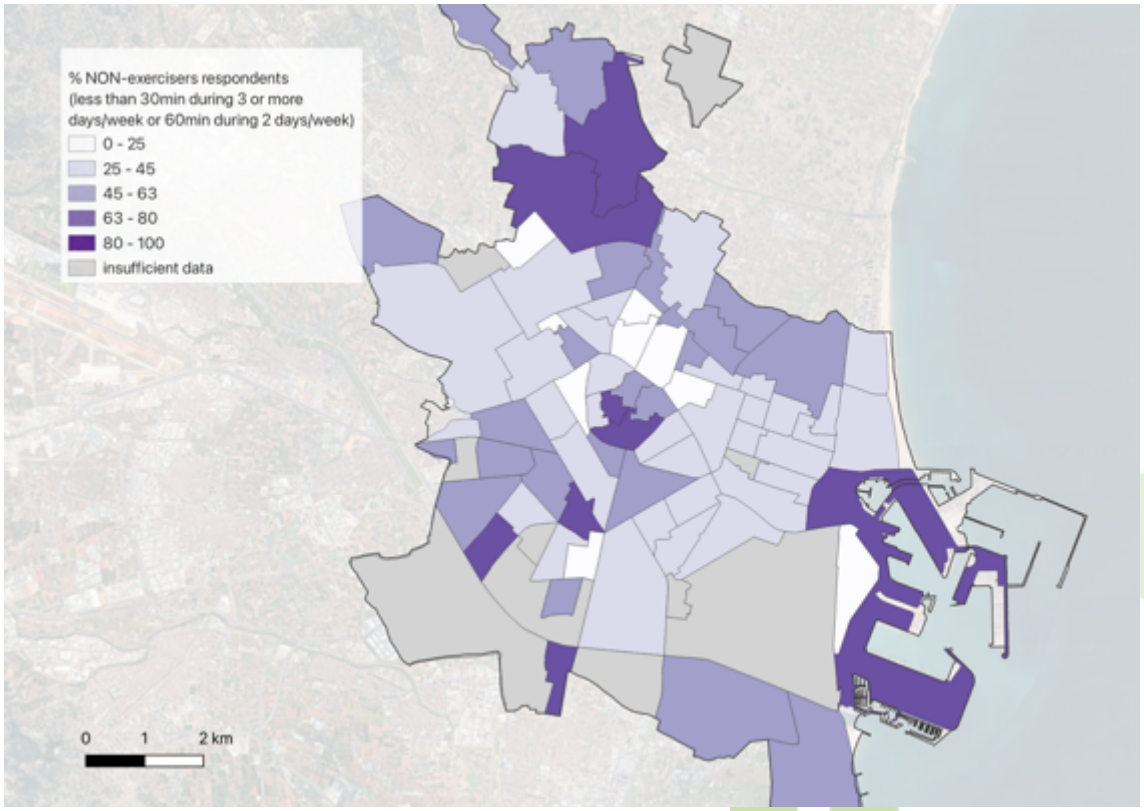


2. Population commuting to daily activities



3. Time dedicated to exercise

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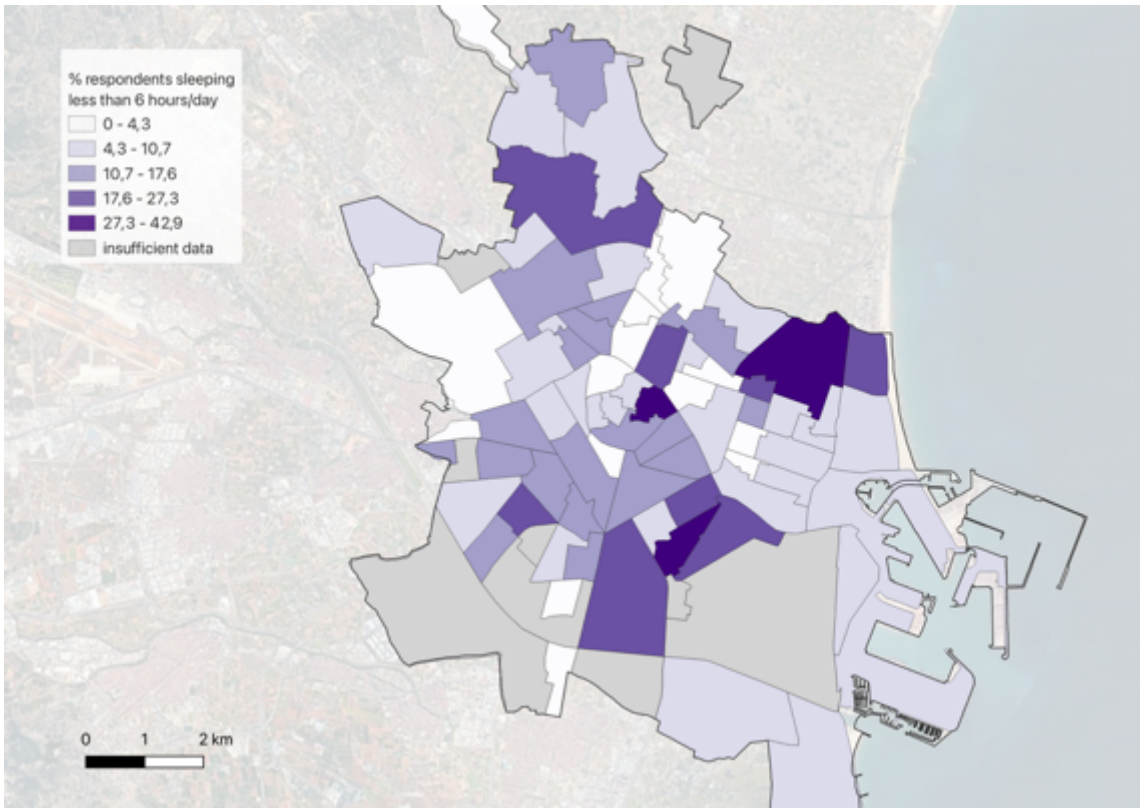
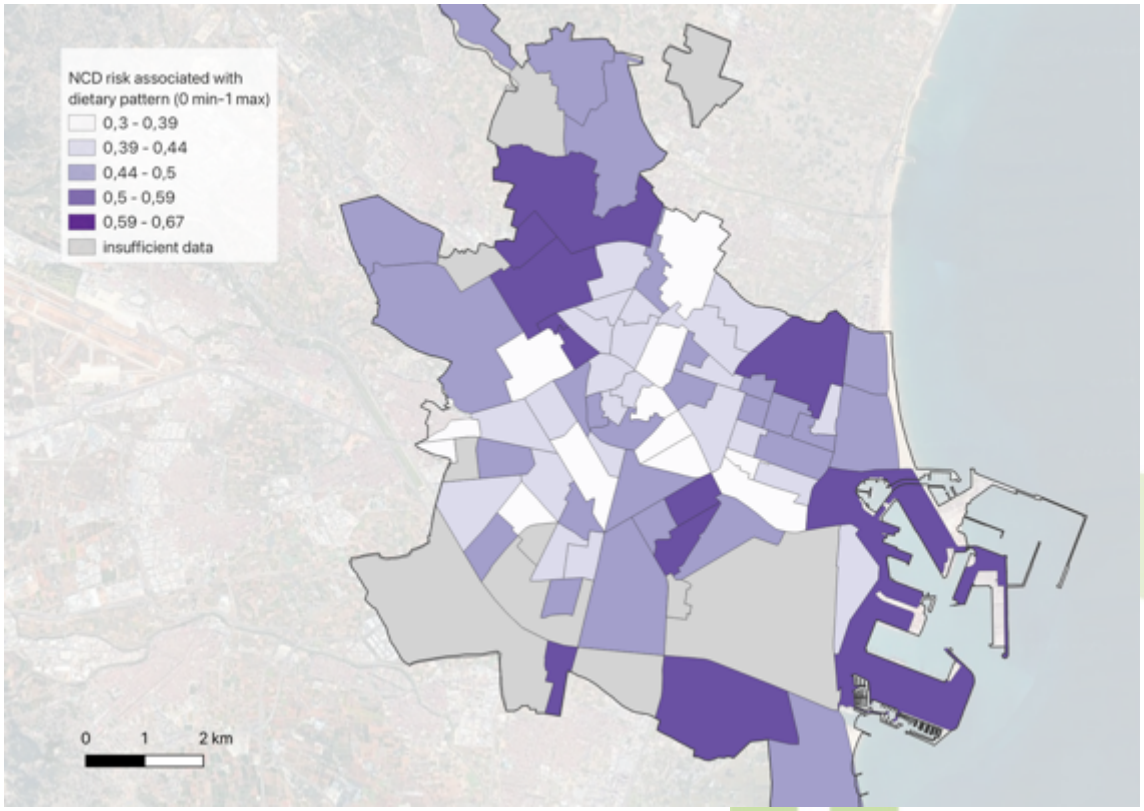


4. Sleeping time



5. NCD risk associated with dietary pattern

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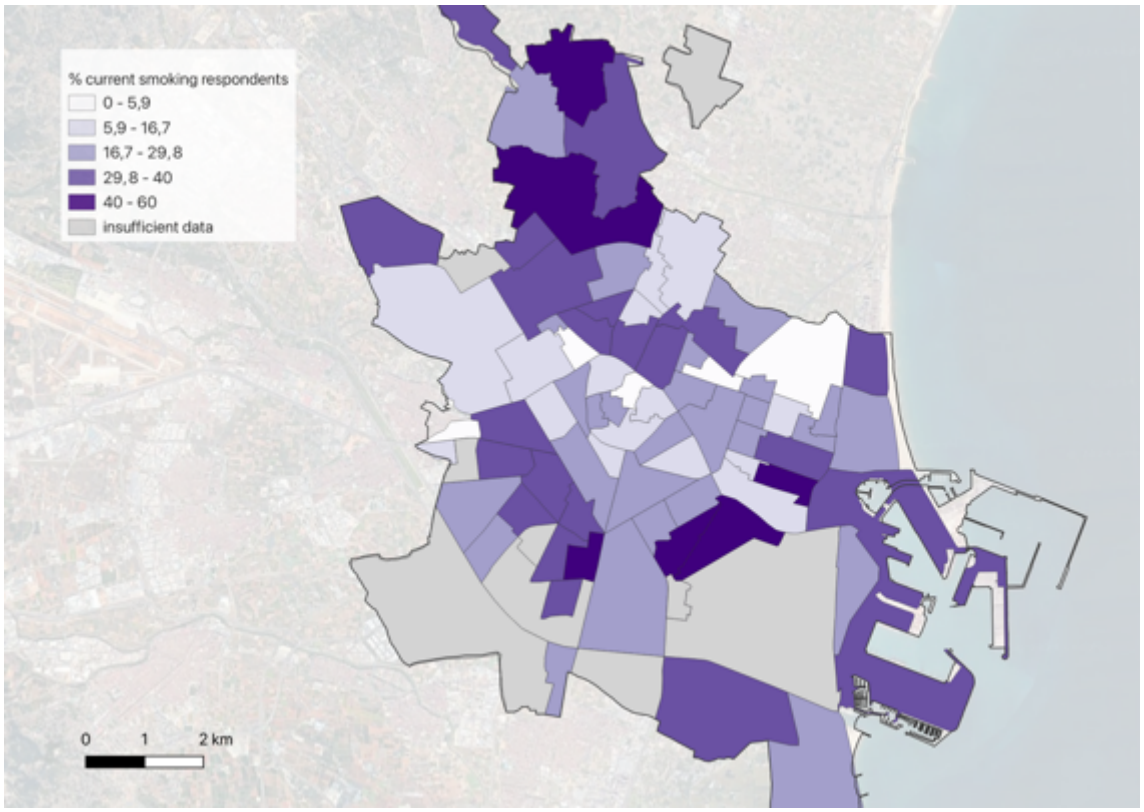
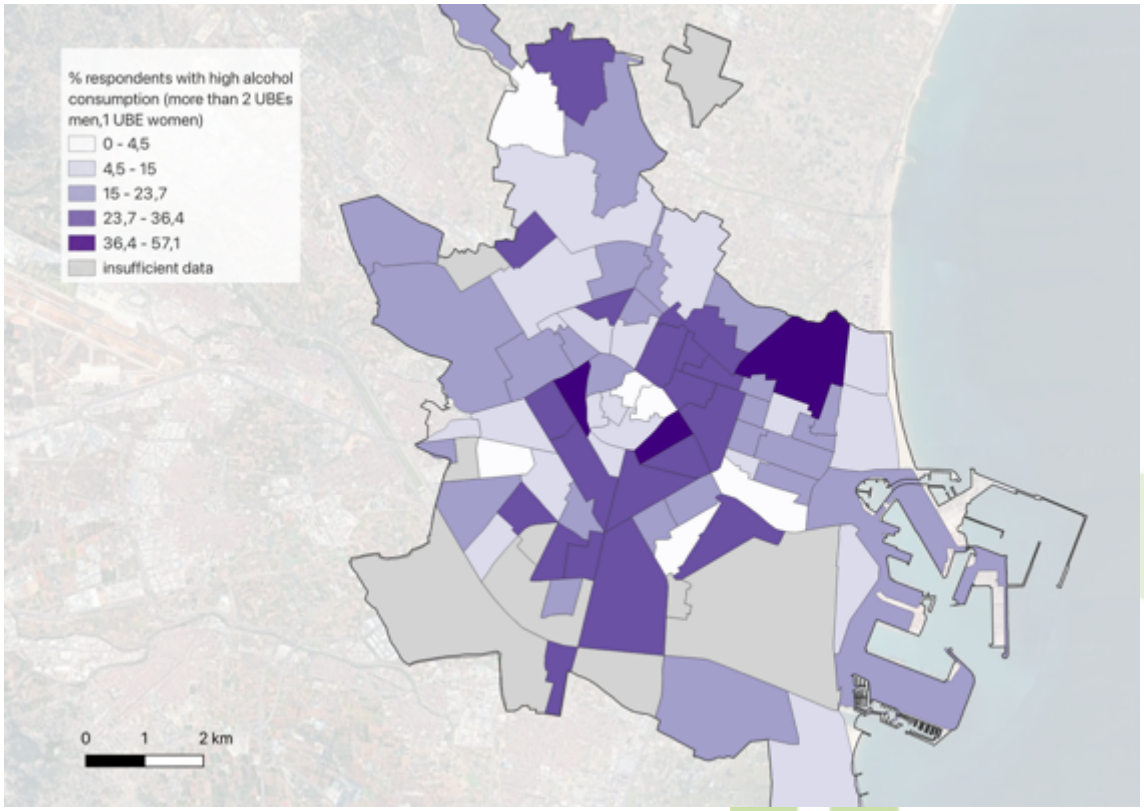


6. Smoking habits



7. Alcohol consumption

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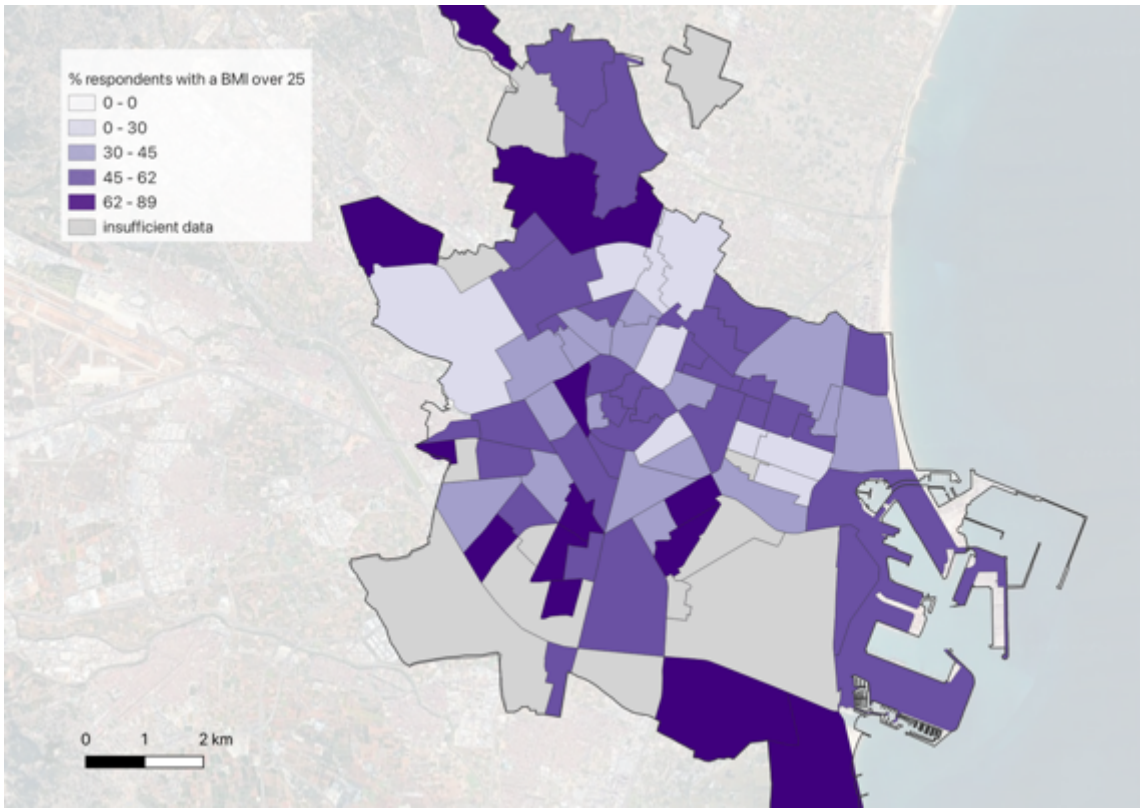
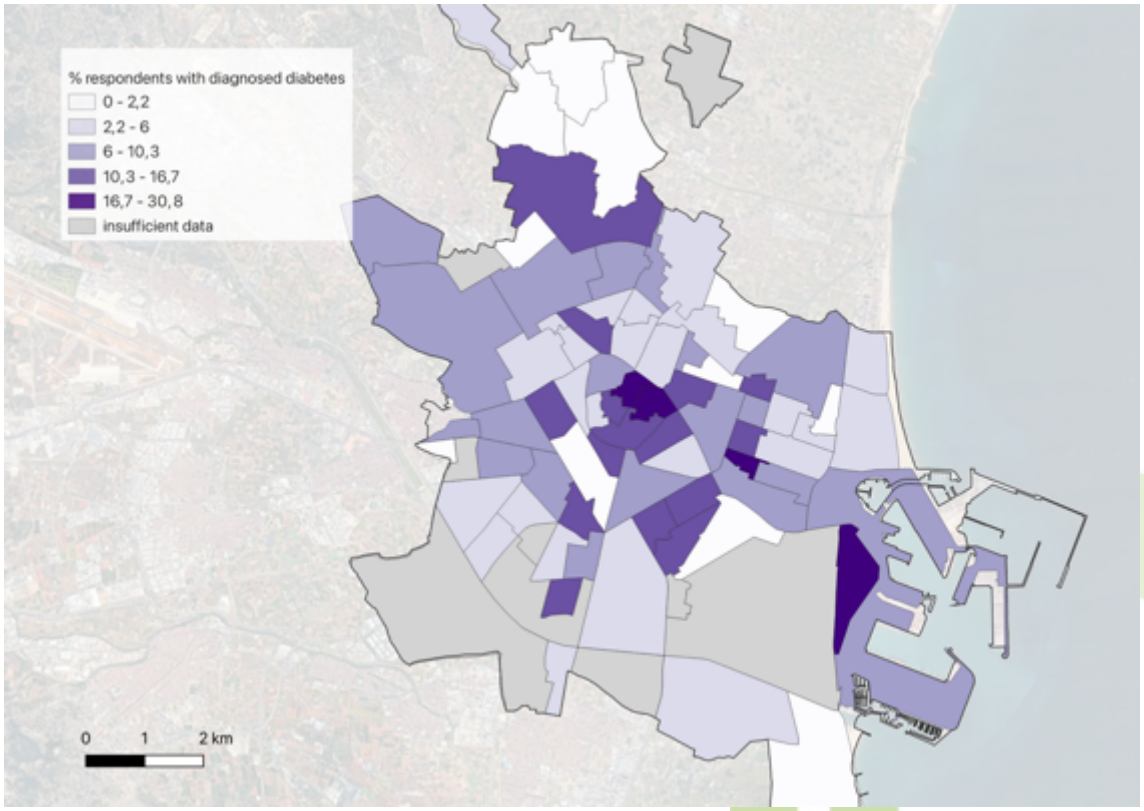


8. Overweight



9. Population with diagnosed diabetes

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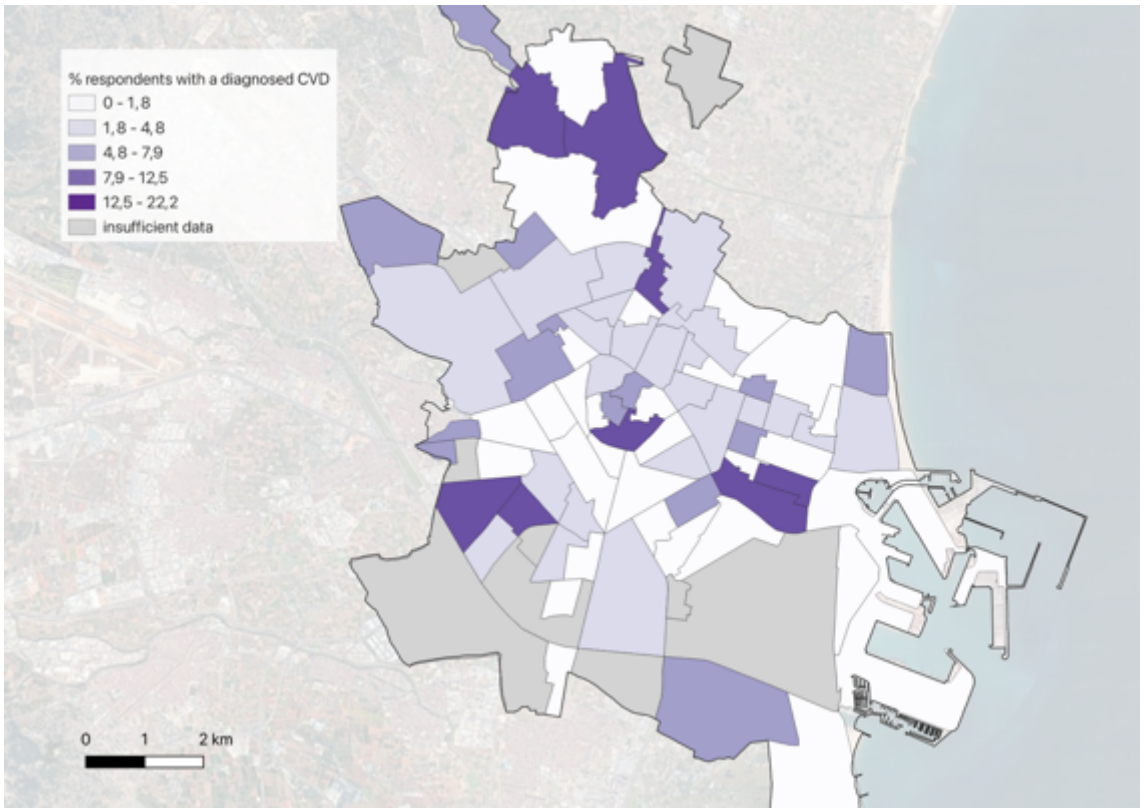

10. Population with diagnosed CVD

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ANNEX 1: DATA SOURCES

Rijeka

- Census: census data per neighbourhood to calculate population density
- Rijeka GTFS: to locate public transport stops. Provided by the University of Rijeka, Faculty of Maritime Studies, Department for Transportation

Rotterdam

- Census: census data per neighbourhood to calculate population density
- OVapi GTFS: location of public transport stops (source: transitfeeds.com/p/ov/814)
-

Valencia

- Census: census data per neighbourhood to calculate population density
- MetroValencia GTFS: location of metro stations (source: transitfeeds.com/p/ferrocarriles-de-la-generalidad-valenciana/1039?p=6)
- EMT GTFS: location of bus stops (source: transitfeeds.com/p/emt-valencia/719)

Common data sources

- Corine Land Cover: to identify the urban fabric surface for each urban area (source: land.copernicus.eu/en/products/corine-land-cover)
- NASA Earthdata SRTM: digital elevation model to assess topographic data (source: earthdata.nasa.gov/sensors/srtm)
- NASA Landsat 8 data: to calculate Normalized Difference Vegetation Index (source: landsat.gsfc.nasa.gov)
- OpenStreetMap: location of facilities, services, etc. (source: openstreetmap.org)

The following table contains information on the OpenStreetMap (OSM) data used:

Dataset (input)	Type	key (OSM)	value (OSM)	influence area (or buffer)
Location of facilities	admin_service	*amenity*	*archive, customs, financial_advice, fire_station, public_building*	N/A
		amenity	*courthouse, police, townhall*	1 km
		amenity	*post_office*	0.75 km
	education	*amenity*	*college*	0.75 km
		amenity	*kindergarten, school*	0.5 km
		amenity	*university*	N/A

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	healthcare	*amenity*	*clinic, doctors*	0.5 km
		amenity	*hospital*	N/A
	market	*amenity*	*marketplace*	0.5 km
Location of other social services	sociocultural	*amenity*	*arts_centre, community_centre*	0.5 km
		amenity	*cemetery, place_of_worship*	N/A
		amenity	*concert_hall, conference_centre, events_venue, theatre*	1 km
		amenity	*events_centre, library, social_centre, social_facility*	0.5 km
Location of sport facilities	sports	*leisure*	*stadium, recreation_ground, disc_golf_course, fitness_station, horse_riding, pitch, sports_hall, swimming_pool*	N/A
			sports_centre	0.75 km
Location of green areas	green area	*leisure*	*park*	0.75 km
Location of public transport stops	public transport	*public_transport*	*station*	1 km
Location of bicycle stations, parking	cycle infrastructure	*amenity*	*bicycle_parking bicycle_repair_station*	
Location of pedestrian facilities	pedestrian facility	*amenity*	*bench, chair, drinking_water, shelter, shower, toilets, water_point*	
Location of services, shops, commerce	business	*amenity*	*atm, bank, bar, bicycle_rental, bureau_de_change, cafe, car_rental, car_wash, casino, childcare, cinema, dancing_school, dentist, dive_centre, driving_school, exhibition_centre, fast_food, first_aid_school, food_court, fuel, ice_cream, language_school, money_transfer, music_school, music_studio, music_venue, nightclub, nursing_home, payment_centre, pharmacy, planetarium, pub, research_institute, restaurant, stage, studio, surf_school, toy_library, traffic_park, training,vehicle_inspection, vending_machine, veterinary*	

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Location of services, shops, commerce	business - commerce	*shop*	*agrarian, anime, antiques, appliance, art, atv, baby_goods, bag, bathoom_furnishing, beauty, bed, bicycle, boat, bookmaker, books, boutique, camera, candles, cannabis, car, car_parts, car_repair, caravan, carpet, charity, chemist, clothes, collector, computer, copyshop, cosmetics, country_store, craft, curtain, department_store, doityourself, doors, dry_cleaning, e-cigarette, electrical, electronics, energy, erotic, fabric, fashion, fashion_accessories, fireplace, fishing, flooring, florist, frame, fuel, funeral_directors, furniture, games, garden_centre, garden_furniture, gas, general, gift, glaziery, golf, groundskeeping, hairdresser, hairdresser_supply, hardware, hearing_aids, herbalist, hifi, household_linen, houseware, hunting, interior_decoration, jewelry, kiosk, kitchen, laundry, leather, lighting, locksmith, lottery, mall, massage, medical_supply, military_surplus, mobile_phone, model, money_lender, motorcycle, motorcycle_repair, music, musical_instrument, newsagent, nutrition_supplements, optician, outdoor, outpost, paint, party, pawnbroker, perfumery, pest_control, pet, pet_grooming, photo, pottery, printing, printer_ink, pyrotechnics, radiotechnics, religion, rental, scooter, scuba_diving, second_hand, security, sewing, shoe_repair, shoes, ski, smartshop, snowmobile, sports, stationery, storage_rental, surf, swimming_pool, tailor, tattoo, telecommunication, ticket, tiles, tobacco, tool_hire, toys, trade, trailer, travel_agency, trophy, truck, tyres, vacant, vacuum_cleaner, variety_store, video, video_games, watches, water_sports, wholesale, window_blind, wool*	
Location of fresh food and grocery shops	food shop	*shop*	*alcohol, bakery, beverages, brewing_supplies, butcher, cheese, chocolate, coffee, confectionery, convenience, dairy, deli, farm, food, frozen_food, greengrocer, health_food, ice_cream, nuts, pasta, pastry, seafood, spices, supermarket, tea, water, wine*	
Location of urban agriculture or allotment areas	urban agriculture	*landuse*	*allotments, greenhouse_horticulture, orchard, vineyard*	
Streets network	highway level 1	*highway*	*motorway, motorway_link, trunk, trunk_link*	75m (150m total)
Network	highway level 1	*railway*	*rail*	75m (150m total)
Streets network	highway level 2	*highway*	*primary, primary_link, secondary, secondary_link, tertiary, tertiary_link*	25m (50m total)
Streets network	-	*highway*	*residential, service*	

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Streets with no permission or restricted to motorised traffic	-	*highway*	*footway, living_street, pedestrian*
Location of open public areas	open public area	*leisure*	*biergarten, dog_park, playground, beach, square*

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ANNEX 2: DESCRIPTION OF ATTRIBUTES

Physical & functional attributes

Population density

A healthy city should have medium population density (between 50-150 dwellings/Ha), buildings between 3 to 6 storeys high, avoid low-density development, prioritise the re-use of existing buildings, and enhance continuity between the city centre and suburbs.

Business and retail density

Business density refers to the ratio of economic activity per inhabitant.

A healthy city should create space for economic activity in accessible and well-connected areas, foster commerce in a balanced way alongside housing, prioritise the re-use of existing buildings, promote locally based businesses, and link new areas of economic activity with existing ones.

Street connectivity

Street connectivity refers to the way streets are connected to each other, which determines how easy it is to move around.

A healthy city should avoid dead-end streets and distances greater than 120m between intersections. Different mobility networks should be interlinked, and pedestrians and cyclists should have priority at intersections.

Location connectivity

Direct connection to the places that people want to go, such as services, shops, parks and public transport routes.

A healthy city should ensure good connection between points of interest like public services, green spaces and commercial areas. Likewise, neighbourhoods should be well connected to each other and to the city centre.

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Cyclability

Cyclability refers to the length, structure, extension and quality of the city's bicycle lane network.

A healthy city should ensure that the cycle network connects residential areas, different neighbourhoods, public services, green spaces and commercial areas. The cycle network should also be connected to a natural environment network.

Walkability

Walkability refers to the ability to move comfortably, safely and pleasantly around a city on foot.

A healthy city should ensure quality pedestrian infrastructure provides access to public services from the houses. Pedestrian infrastructure should be sufficiently wide, separate from motorised traffic and maintain continuity at intersections, avoiding physical barriers and level changes. High quality, comfortable streets also include greenery, commercial activity at street level, sheltered spaces (from sun or rain) and resting places along the routes.

Public transport

Public transport refers to the structure, connectivity, and availability of the public transport network.

A healthy city should ensure that public transport has a clear structure and good coverage with a network that covers the main streets and facilitates access from all neighbourhoods.

Traffic

Traffic refers to the density, type, and speed of vehicles.

A healthy city should implement measures to reduce the speed and volume of motorised traffic. These include restrictions for motorised vehicles in urban areas, alternative parking in city outskirts, minimising space for motorised private transport, and speed reduction measures.

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Proximity to public spaces

It refers to residential proximity to green areas and open public spaces. It takes into account the distance to green areas (proximity to green areas), rather than the amount of greenery in the city as a whole.

A healthy city should ensure access from housing to green areas at a distance of 300-400m.

Food environment

A healthy food environment ensures access to healthy food in the immediate area. A healthy city should promote a healthy food environment, improving access and connection to municipal markets and implementing planning measures to support grocery stores and fresh-food shops in all the neighbourhoods.

Green coverage

Green coverage refers to the total amount of greenery in the city. A healthy city should increase green coverage and green visibility of all types of greenery including public green areas, private green areas, the street tree canopy, etc.