



Università
di Catania

Master's degree in Data Science for Management
Course: Data Base and Big Data Analytics
Module: Big Data Analytics

Report Title

City of Barcelona

Students:
Esfandiaryfard Anahita
Incardona Biagio

Academic Year 2020/2021

Contents

1 Starting Dataset	4
2 Business Questions	5
3 Data Model	5
3.1 Disclaimer	6
3.2 Dimensional Fact Model	6
4 ETL Process	7
4.1 Accident	8
4.2 Air Quality	8
4.3 Expectancy	9
4.4 Transport	9
4.5 Aggregate	10
4.6 Clean step only	11
5 Dashboards	11
5.1 Overview Dashboard	12
5.2 Demographic Dashboard	13
5.2.1 Population chart	14
5.2.2 Birth by Year	14
5.2.3 Deaths by Age	15
5.2.4 Population by Year	16
5.2.5 Population by District	16
5.2.6 Age	17
5.3 Life Quality Dashboard	17
5.3.1 % Of Population exposed to a Pollution Noise Level by District	18
5.3.2 Air quality by district	19
5.3.3 Transportation	20
5.4 Accidents Dashboard	20
5.4.1 Accidents per Hour	21
5.4.2 Accidents per Year	22
5.4.3 Number of accidents per Month	23
5.4.4 Number of Accidents per District	24
5.5 Unemployment Dashboard	24
5.5.1 Unemployment by Gender	25
5.5.2 Unemployment Rate by District	26
5.5.3 Unemployment by Year	27
5.5.4 Unemployment Rate	27
5.6 Immigration Dashboard	28
5.6.1 Immigrants	28
5.6.2 Immigrants by Age	29
5.6.3 Immigrants by Country	30
5.7 Life expectancy dashboard	30

5.7.1	Life Expectancy	31
5.7.2	Life Expectancy by District	31
5.7.3	Life Expectancy by Gender	32
5.7.4	Life Expectancy by Year	33
6	Conclusions	33
6.1	Demographic questions	33
6.1.1	How many people live in Barcelona and how is the distribution of these people in districts?	33
6.1.2	How did population change during years divided by gender?	33
6.1.3	Do people tend to have children?	33
6.1.4	How is the distribution of age of population?	33
6.1.5	How death is distributed across the age?	33
6.2	Life Quality questions	34
6.2.1	At which level of noise pollution I can expect to live?	34
6.2.2	What is the air quality of the districts?	34
6.2.3	Which transportation is more accessible in the city?	34
6.3	Immigration questions	34
6.3.1	What is the number of immigrants in Barcelona?	34
6.3.2	What is most frequent nationality in Barcelona?	34
6.3.3	At what age people tend to migrate more to Barcelona?	34
6.4	Accidents questions	34
6.4.1	In what hour number of accidents are higher?	34
6.4.2	Is the number of accidents different at weekends?	34
6.4.3	Is the number of accidents changed over the years?	34
6.4.4	In which month number of accidents are higher?	34
6.4.5	In what district more accidents happen?	34
6.5	Unemployment questions	35
6.5.1	What is the unemployment rate in Barcelona?	35
6.5.2	How did the unemployment rate change during the years?	35
6.5.3	Does Women have an higher unemployment rate than men?	35
6.5.4	What district has a higher/lower unemployment rate?	35
6.6	Life Expectancy questions	35
6.6.1	How much is life expectancy in city of Barcelona?	35
6.6.2	Do women live more than men in Barcelona?	35
6.6.3	How life expectancy change in each district?	35
6.6.4	Is there a district with a better life expectancy?	35
6.6.5	How life expectancy changed during years?	35
7	Color Blindness Test	35
7.1	Protanomaly- Red weak	36
7.2	Deuteranomaly- Green weak	39
7.3	Tritanomaly- Blue weak	42
7.4	Protanopia- red blind	45
7.5	Deuteranopia - Green blind	48
7.6	Tritanopia - blue blind	50

7.7	Monochromacy - Achromatopsia	53
7.8	Monochromacy- Blue Cone	56

1 Starting Dataset

The report is based on data relating to the **City of Barcelona**. The data have been imported from different sources and then combined together.

From the data source <https://www.kaggle.com/xvivancos/barcelona-data-sets>, 13 tables in "csv" format have been selected:

- **Accidents_2017** table (10335 records): Contains List of accidents handled by the local police in the city of Barcelona in 2017.
- **Air_quality_Nov2017** Air_quality_Nov2017 table (8 records): Contains measure data for air quality in 2017.
- **Air_stations_Nov2017** table (8 records): Contains Main characteristics of the air quality measure stations.
- **Births** table (734 record): Contains Births by nationalities and by neighborhoods of the city of Barcelona (2013-2017).
- **Bus_stops** table (3162 records): Contains Bus stops, day bus stops, night bus stops, airport bus stops of the city of Barcelona(2013-2017).
- **Deaths** table (4599 records): Contains Deaths by quinquennial ages and by neighborhoods of the city of Barcelona (2015-2017).
- **Immigrants_by_nationality** table (35200 records): Contains Immigrants by nationality and by neighborhoods of the city of Barcelona (2015-2017).
- **Immigrants_emigrants_by_age** table (4662 records): Contains Immigrants and emigrants by quinquennial ages and by neighbourhood of the city of Barcelona (2015-2017).
- **Immigrants_emigrants_by_sex** table (730 records): Contains Immigrants and emigrants by sex by neighborhoods of the city of Barcelona (2013-2017).
- **Life_expectancy** table (73 records): Contains Life expectancy of the city of Barcelona (five years). 2006-2013¹
- **Population** table (70000 records): Contains Population by neighbourhood, by quinquennial ages and by genre of the city of Barcelona (2013-2017). Reading registers of inhabitants.
- **Transports** table (651 records): Contains Public transports (underground, Renfe, FGC, funicular, cable car, tramcar, etc) of the city of Barcelona.
- **Unemployment** table (14200 records): Contains Registered unemployment by neighbourhood and genre in the city of Barcelona (2013-2017).

From the data source <https://www.kaggle.com/marcvelmer/barcelona-accidents>, Four tables in "csv" format have been selected to complete Accident table information of initial table:

- **2013_Accidents** table (8612 records)
- **2014_Accidents** table (8777 records)
- **2015_Accidents** table (9104 records)
- **2016_Accidents** table (9344 records)

From the data source <https://opendata-ajuntament.barcelona.cat/data/dataset/poblacio-exposada-mapa-estrategic-soroll>, one tables in "csv" format have been selected:

- **Acoustic noise** table (2601 records): Contains the information of rang noise for each district.

¹The years are grouped in 4 year groups, ending with a total of 5 different groups of years

2 Business Questions

The goal of the report is to answer to all the questions someone who's planning to move into Barcelona could have. The questions are divided into some topics (**Demographic**, **Life Quality**, **Accidents**, **Employment**, **Immigration**, **Life Expectancy**) and they are the following ones:

- **Demographic:**

- How many people live in Barcelona and how is the distribution of these people in districts?
- How did population change during years divided by gender?
- Do people tend to have children?
- How is the distribution of age of population?
- How death is distributed across the age?

- **Life Quality:**

- At which level of noise pollution I can expect to live?
- What is the air quality of the districts?
- Which transportation is more accessible in the city?

- **Immigration:**

- What is the number of immigrants in Barcelona?
- What is most frequent nationality in Barcelona?
- At what age people tend to migrate more to Barcelona?

- **Accidents:**

- In what hour number of accidents are higher?
- Is the number of accidents different at weekends?
- Is the number of accidents changed over the years?
- In which month number of accidents are higher?
- In what district more accidents happen?

- **Unemployment:**

- What is the unemployment rate in Barcelona
- How did the unemployment rate change during the years?
- Does Women have an higher unemployment rate than men?
- What district has a higher/lower unemployment rate?

- **Life Expectancy:**

- How much is life expectancy in city of Barcelona?
- Do women live more than men in Barcelona?
- How life expectancy change in each district?
- Is there a district with a better life expectancy?
- How life expectancy changed during years?

3 Data Model

In this section the Dimensional Fact Model will be presented.

3.1 Disclaimer

We decided to begin this section with a disclaimer. Regarding our purpose because of the form of the data we have here, we could not completely implement the dimensional fact model we had in mind so here we explain the design we made but in the project, we just implemented the part that was possible..

The DFM (Dimensional Fact Model) was not effectively implemented because all the operations for this project should have been done using only Tableau and Tableau Prep Builder, and these two software don't allow to physically create new columns completely by scratch (e.g. a key column for the dimensions), operation that is fundamental in designing an optimized and usable Data Ware House using any of the most common design patterns for Data Warehouses (e.g. Star Schema or Snowflake Schema).

For this reason the data have been arranged in the best possible way to make all the steps as understandably and fast as possible.

3.2 Dimensional Fact Model

The dimensional fact model (DFM) is an ad hoc and graphical formalism specifically devised to support the conceptual modeling phase in a DW project.

In the considered dataset, we have 12 **fact** tables, which are Death, Acoustic noise, Employment, Immigrants by Age, Immigrants by Gender, Immigrants by nationality, Accidents, Air quality, Transportation, Life expectancy, Population, Birth. The reason for why we have more than one fact is that, we are working on a dataset relating to a city which has more than just one part related to it. We decided to put each part that is related to one job in one fact.

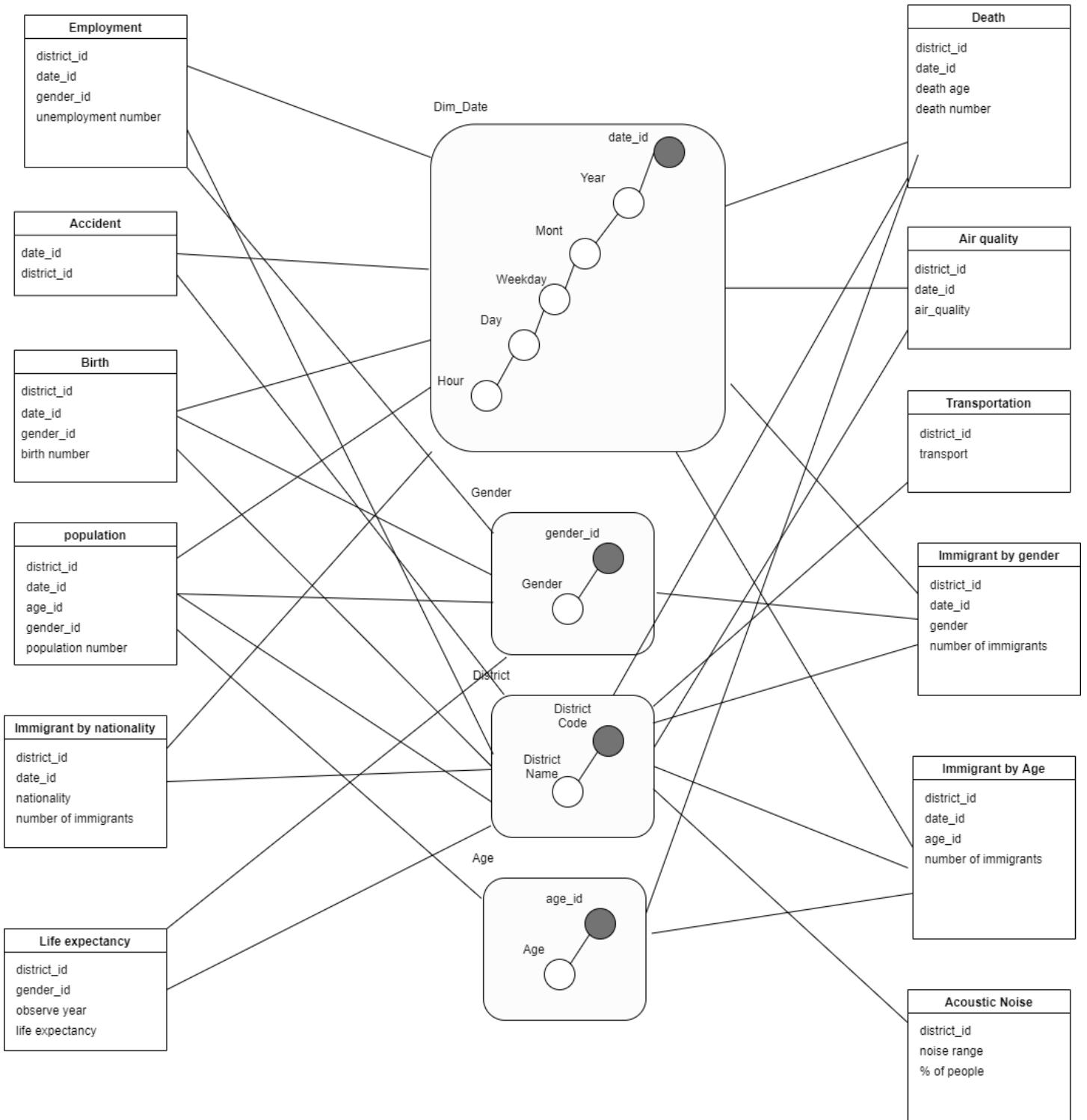
The **measures** representing the properties of Accidents is Weekend, for Birth is Birth gender filter, for Death is Death year filter, for Population are Population gender filter and Population year filter.

A **dimension** is a property, with a finite domain, that describes an analysis coordinate of the fact. Dimensions are represented by Dimensions are represented by small circles, which are linked to the fact by straight lines. In this case the dimensions are: Date, District, Gender and Age. In the analyzed dataset, the dimensional attributes are:

- For **Date**: date_id, year, month, Weekday, Day, Hour
- For **District**: district_id, district_name
- For **Gender**: gender_id, gender
- For **Age**: age_id, age

The relationships among the dimensional attributes are expressed by hierarchies. The functional dependencies are:

- For date_id:
 $date_id \rightarrow year \rightarrow month \rightarrow weekday \rightarrow day \rightarrow hour$
- For district_id:
 $district_id \rightarrow district_name$
- For gender_id:
 $gender_id \rightarrow gender$
- For age_id:
 $age_id \rightarrow age$

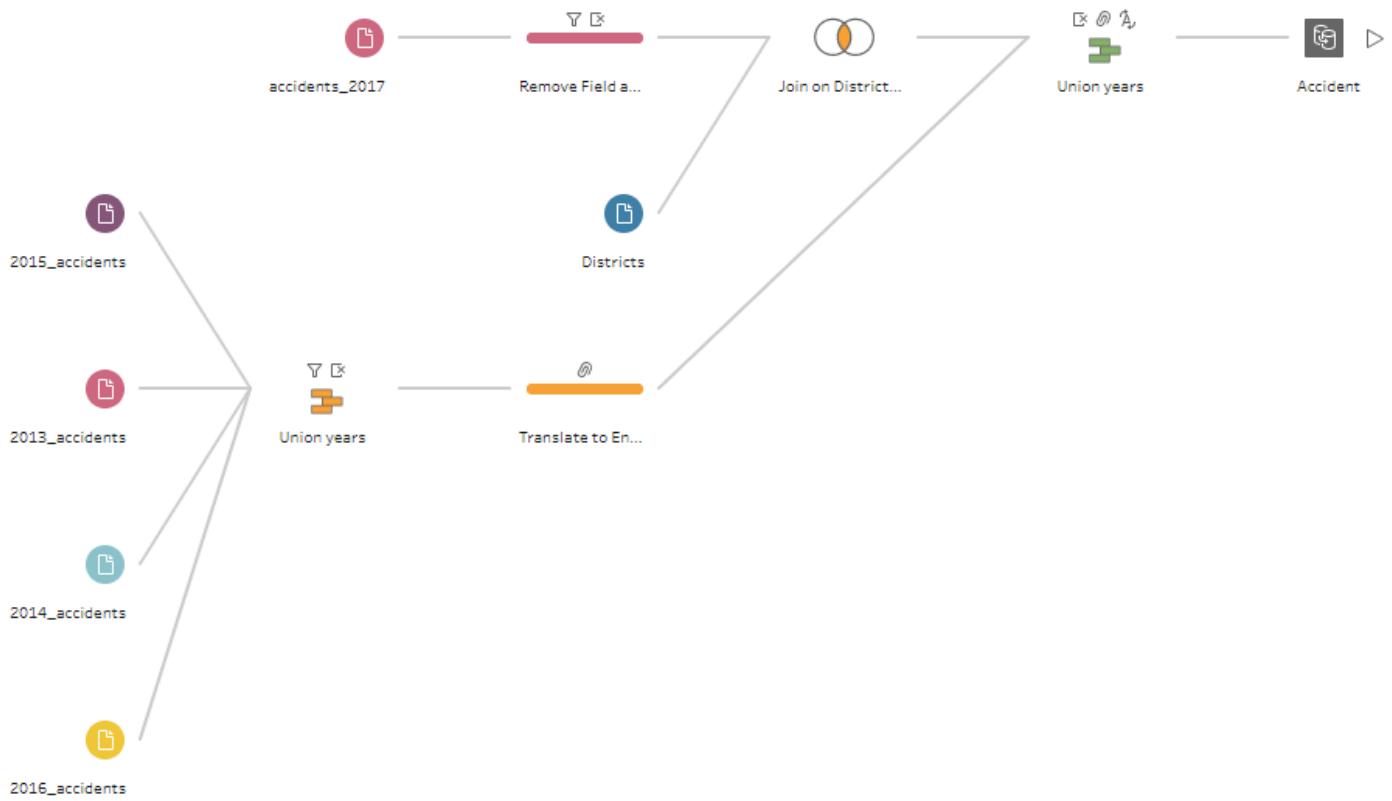


4 ETL Process

Before proceeding with the analysis, data must be cleaned and some tables must be joined and merged. This process was carried out by using Tableau Prep Builder.

Several sections will be written, one for each output file that required a complex process, instead a general summary will be written for those outputs that required only an aggregate step and another section will be done for those that haven't required any particularly complex process, in each sections all the operations done will be discussed.

4.1 Accident



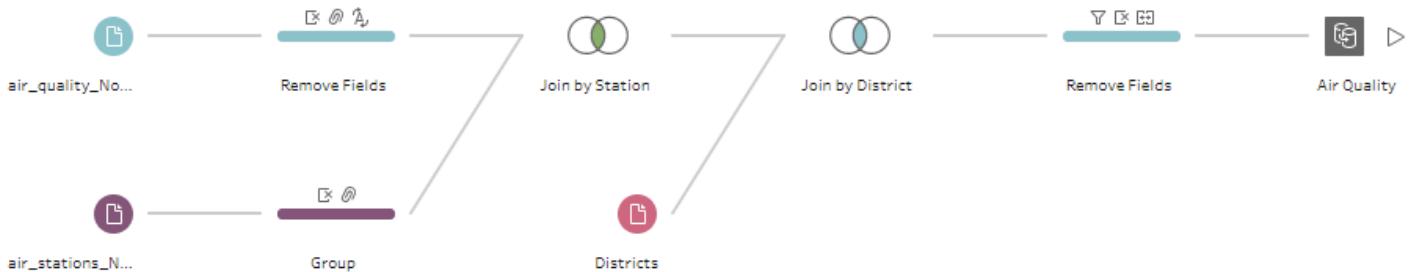
To create the **Accident** output file one join operation has been done and five tables have been merged .
The join was made between the tables **accidents_2017** and **Districts** in order to substitute the District names with the district codes, operation that allows to save space in memory. Then a cleaning step has been applied in order to remove useless columns like *District Name*, *Neighborhood Name* and others.

In parallel 4 tables were merged and cleaned (removing wrong values and useless columns)

- 2016_accidents
- 2015_accidents
- 2014_accidents
- 2013_accidents

Then a final merging operations is made, merging the cleaned **accidents_2017** and the output of the previous merging operation, after that the remaining useless column were removed.

4.2 Air Quality



To create the **Air quality** output file few cleaning steps and two join operation has been done.

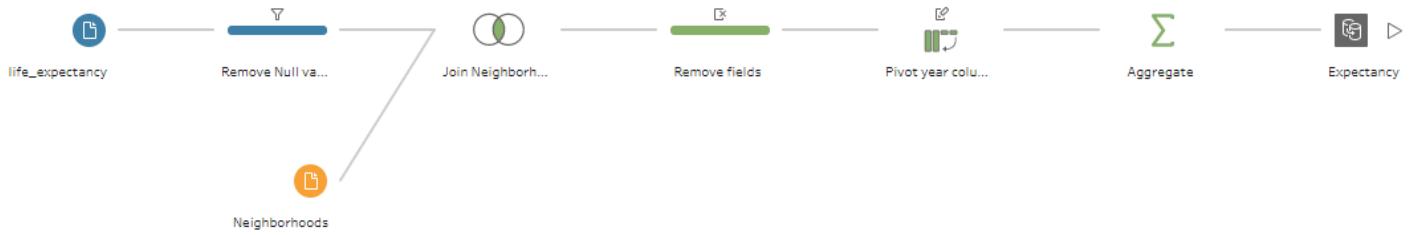
The tables involved are **air_quality_Nov2017** and **air_station_Nov2017**.

First of all a cleaning step was made for both the inputs leaving the unused columns from the tables and renaming some misspelled districts in **air_station_Nov2017**.

The two tables were then joined on the *Station Name* column and the output was joined with the **District** table in order to remove the *District Name* and save space.

Finally the *District Name* and *Station Name* columns were removed and the missing value deleted from the dataset.

4.3 Expectancy

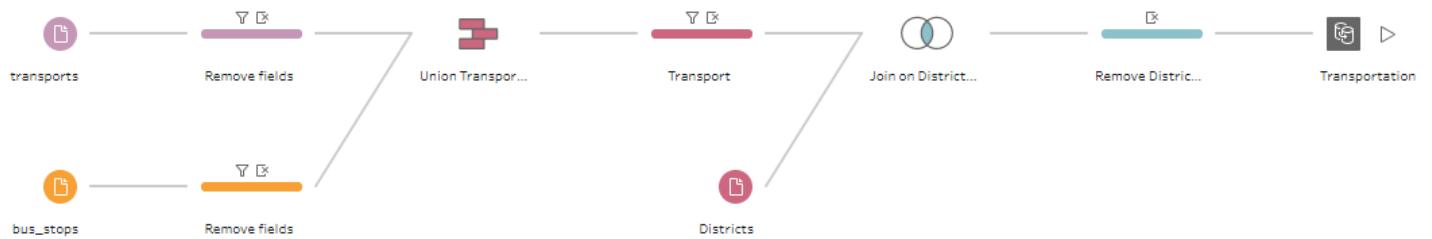


The **life_expectancy** and **Neighbourhoods** inputs are used.

First of all all the null values are removed from the first table, then the two tables were joined on *Neighbourhood Name* column.

Then the information about the neighbourhood were deleted, the years columns were pivoted to make a single column *Observe Year* and the average life expectancy was calculated for each *year-gender-district* combination.

4.4 Transport



In order to make this output three tables were used: **transports**, **bus_stops** and **Districts**.

First of all, all the null values were removed and all the unused columns were removed from **transports** and **bus_stops** leaving the two tables with only two columns: *Transport* and *District Name*.

These two tables were then merged together and the resulting table was joined with the **District** table in order to replace the *District Name* with *District Code* column, so that space can be saved.

4.5 Aggregate



Some different outputs have been grouped together in this category because their operations are really similar each other. The tables involved in this category are: **unemployment**, **immigrants_by_nationality**, **immigrants_emigrants_by_sex** and **immigrants_emigrants_by_age**.

In all the flows the first step is to remove missing values and unused columns, then an aggregation step has been done in each flow.

In **unemployment** flow the **unemployment** table has been used and the average number of unemployed people has been calculated for each distinct combination *Year-District-Gender*.

In **immigrants by nationality** flow the **immigrants_by_nationality** table has been used and the number of immigrants have been summed up for each combination of *Year-District-Nationality*.

In **immigrants by gender** flow the **immigrants_emigrants_by_sex** table has been used and the number of immigrants have been summed up for each combination of *Year-District-Gender*.

In **immigrants by Age** flow the **immigrants_emigrants_by_Age** table has been used and the number of immigrants have been summed up for each combination of *Year-District-Age*.

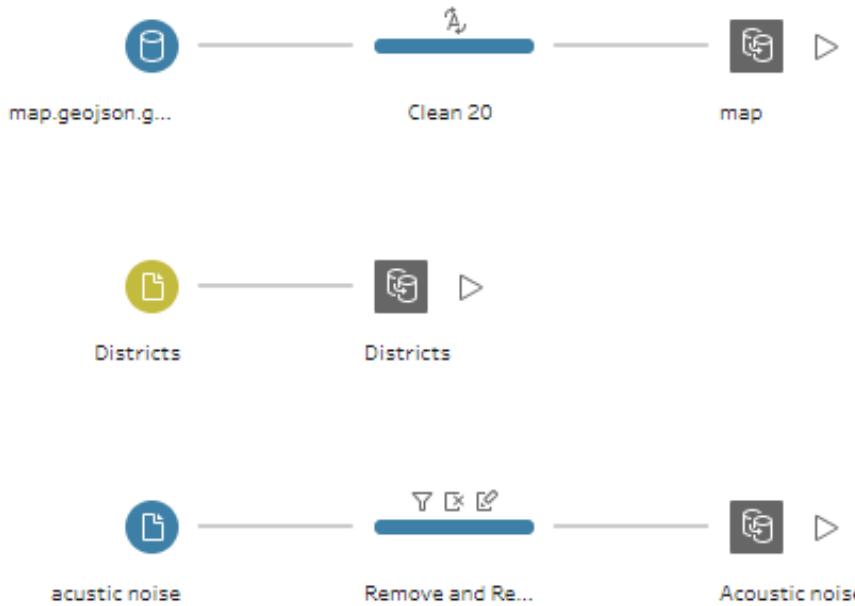
In **Death** flow the **Deaths** table has been used and the number of deaths has been summed up for each combination of *Year-District-DeathAge*.

In **Birth** flow the **Birthss** table has been used and the number of births has been summed up for each combination of *Year-District-Gender*.

In **Death** flow the **Deaths** table has been used and the number of deaths has been summed up for each combination of *Year-District-DeathAge*.

In **Population** flow the **population** table has been used and the number of population has been summed up for each combination of *Year-District-Gender-Age*.

4.6 Clean step only



The remaining tables are: **District**, **Acoustic Noise** and **map**.

District table is already in a perfect form, so it was simply translated in an .hyper file.

The other tables are aggregated data that are not directly related to other data we have, for this data the unused fields were removed, renamed some field to make them equivalent to entire data and changed type when needed.

5 Dashboards

In order to answer the business questions, several dashboards were created, each one aiming to answer to the questions of only one topic. In addition to that an overview dashboard was added to have the possibility to have a fast look at the current

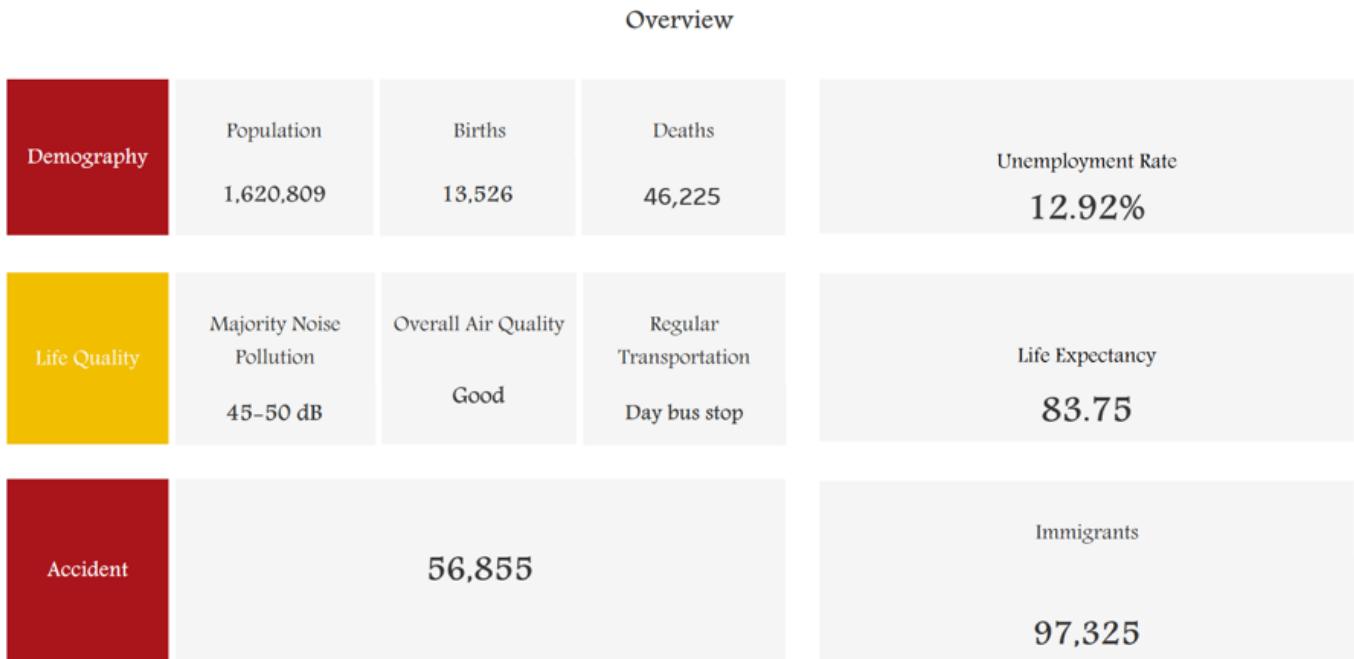
situation of the city. All the dashboard were then organized in a **story**.

Since the persuading nature of the report each visualization has been built with the aim of transmit such an optimistic feeling that is the sentiment that must be felt before taking an important decision like moving into another city.

Not only the dashboard were designed but also a really simple and intuitive **user interface** was implemented in order to give a sense of professionalism to the final users.

In the following sections all the dashboards will be explored, giving a general idea of what the single dashboard is supposed to do and also all the visuals in the dashboard will be discussed in detail.

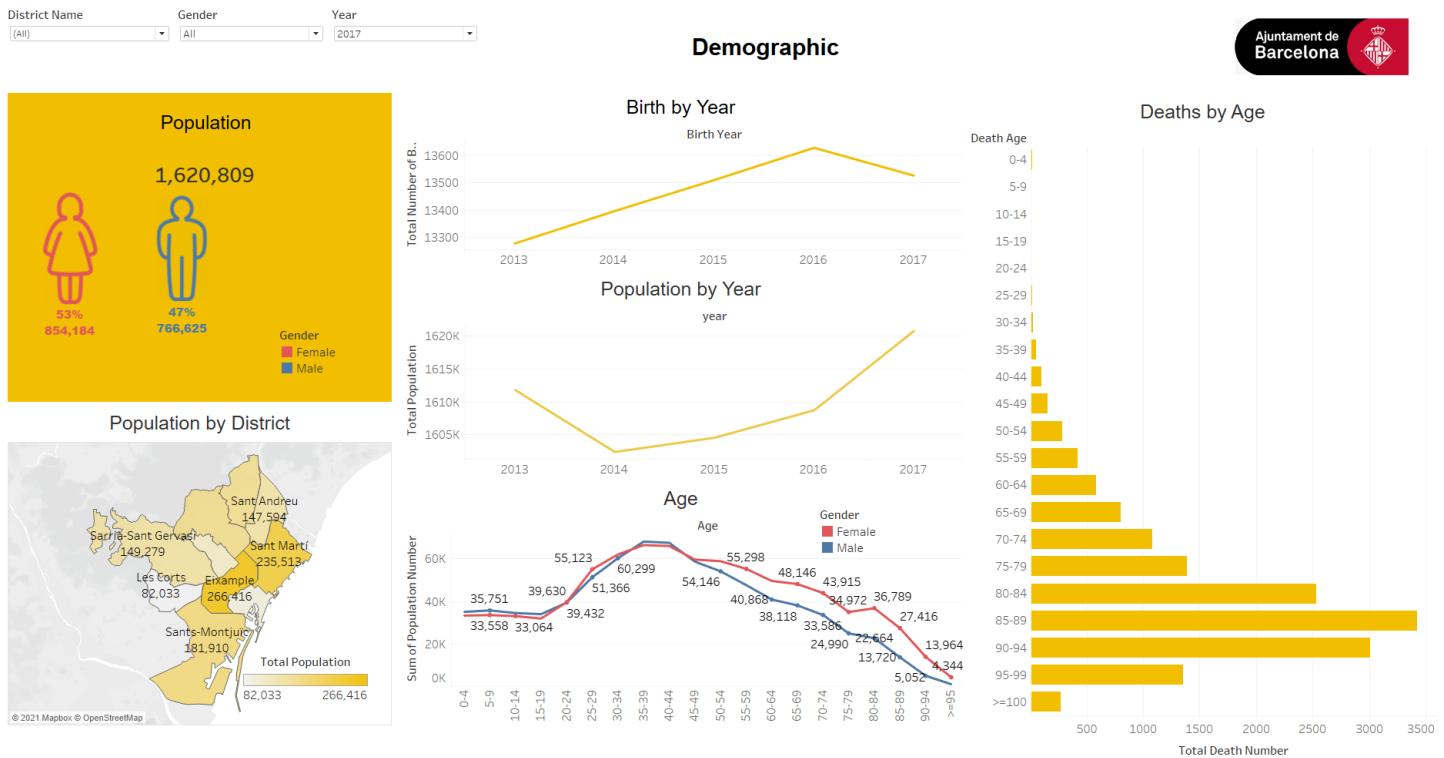
5.1 Overview Dashboard



The Overview dashboard contains general information regarding all the other dashboards, can be used as a fast recap of the current state of Barcelona.

It is composed by several cards, grouped by the related dashboard. In addition to that each card is actually a button that will send the user directly to the related dashboard, in order to have a deeper understanding of the interested data.

5.2 Demographic Dashboard



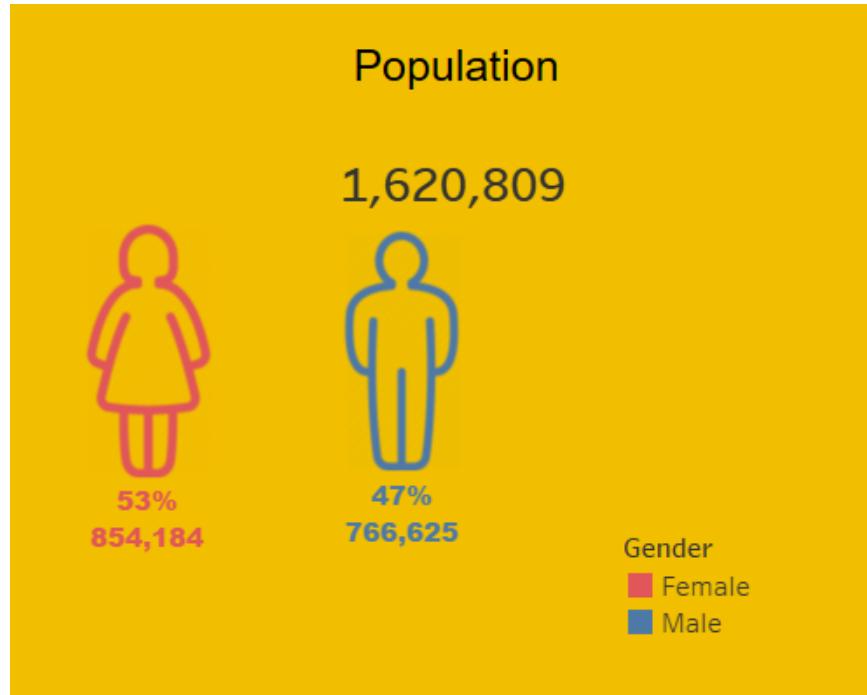
The demographic dashboard has the goal of showing up the demographic composition of Barcelona, giving information about the number of citizens, how they are distributed across the districts of the city, but also how the population is changing over time and if there is a generational renewal.

As can be seen in the image above, the dashboard contains 3 drop down menus, one image and 6 charts.

The 3 drop down menus are actually 3 filters, that will filter the whole dashboard per District, gender and year respectively (left to right).

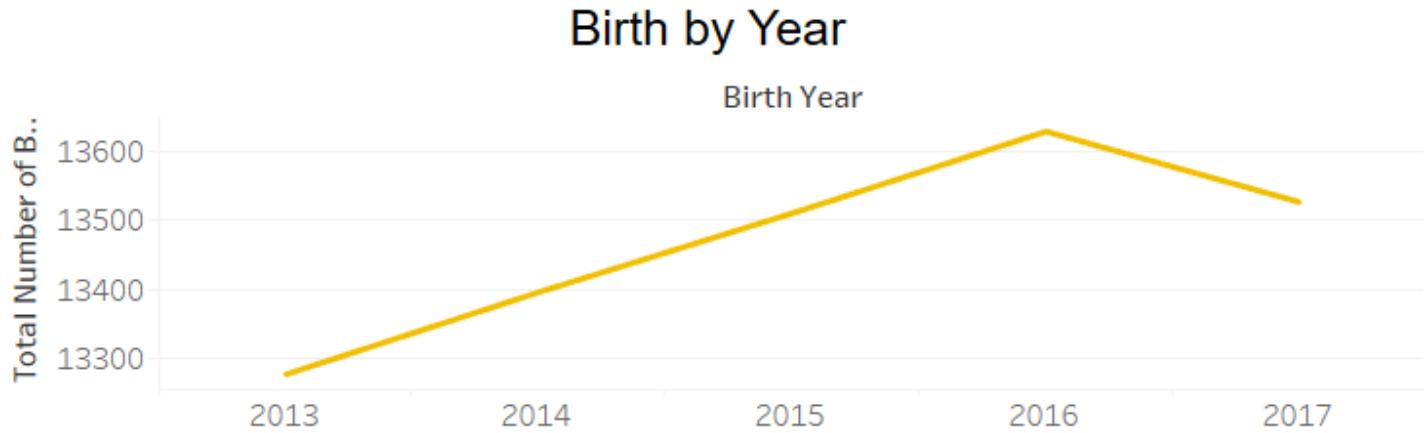
The image contains the Logo of Barcelona and can act like a button that can send the user directly to the overview dashboard. In the following sections the single charts of the dashboard will be discussed

5.2.1 Population chart



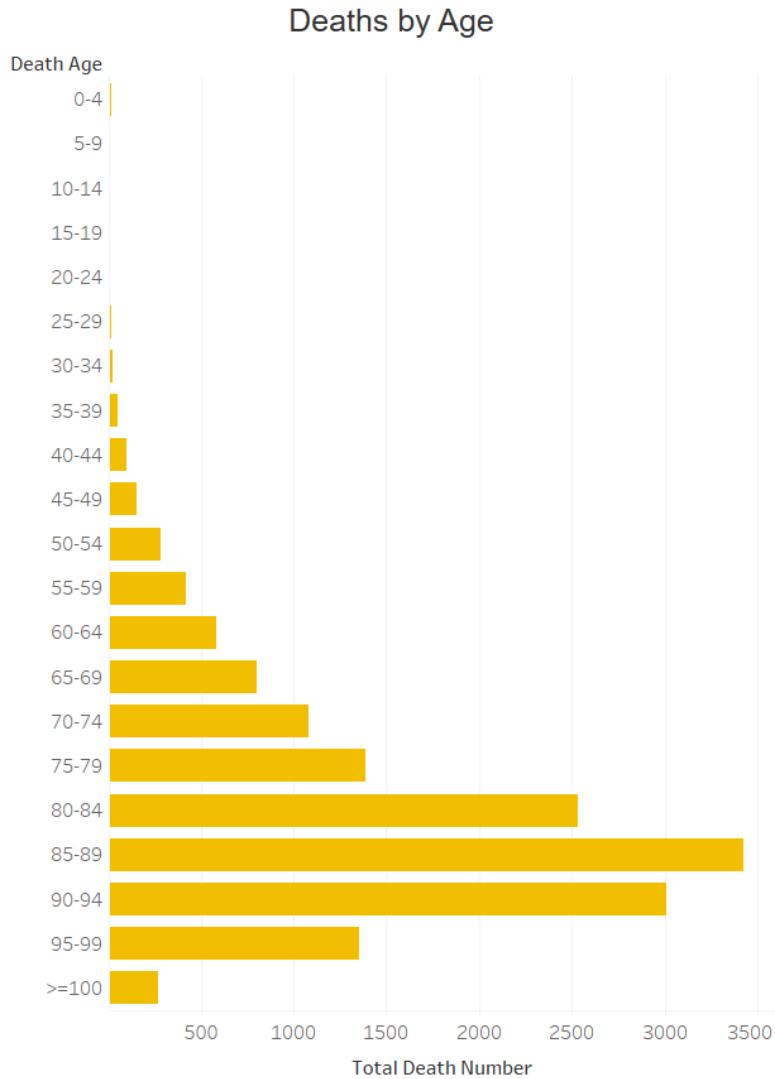
This chart is a card that shows up the total amount of population and how they are distributed across the gender, information visualized both as a whole number and the percentage of the total population.

5.2.2 Birth by Year



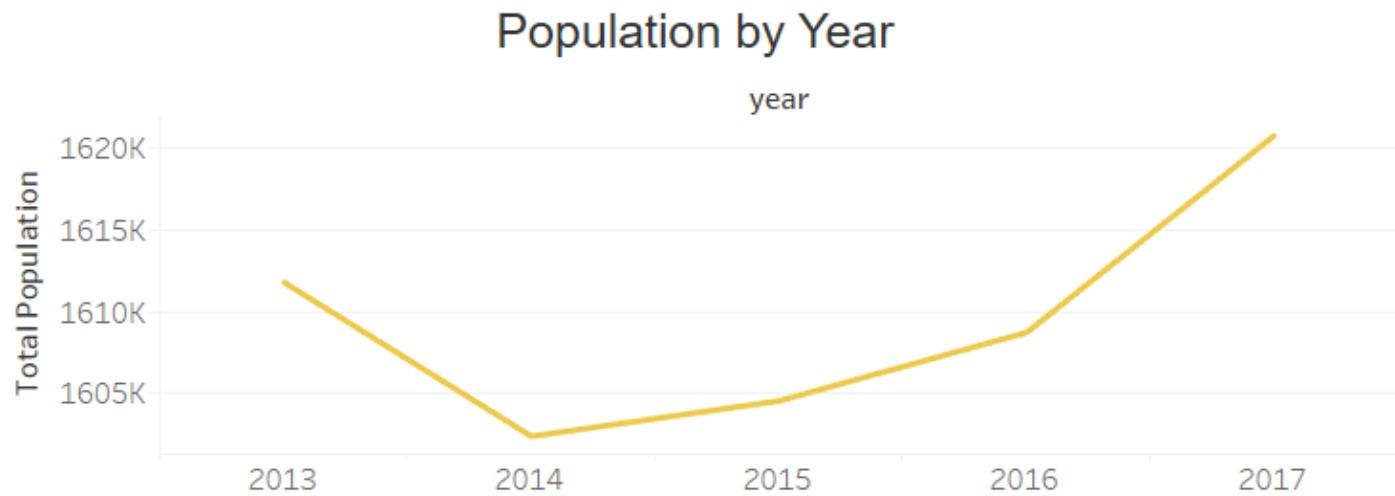
This chart consists of a line chart that shows how the number of births changed over the years.

5.2.3 Deaths by Age



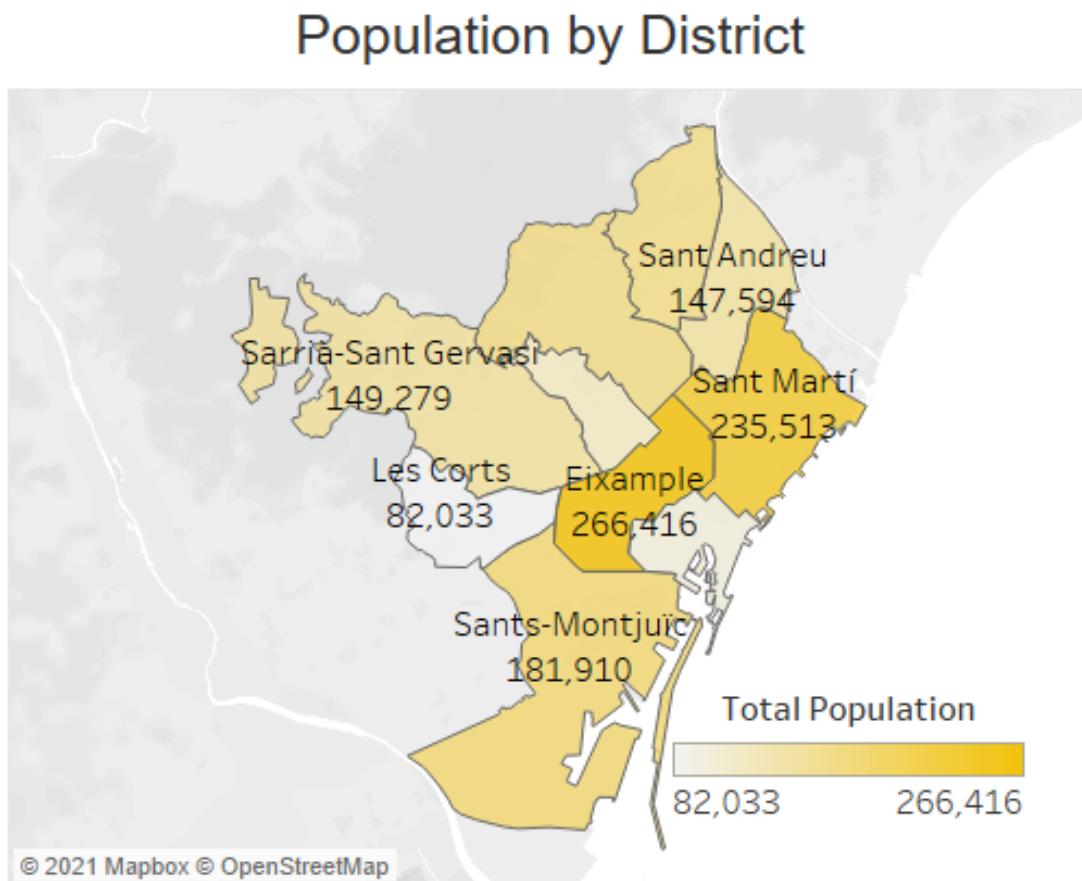
With this chart the distribution of deaths in the city is shown. It is a bar chart in which each bar is the amount of deaths happened in a certain age range.

5.2.4 Population by Year



This line chart has the goal to show how the amount of population has changed during the last years

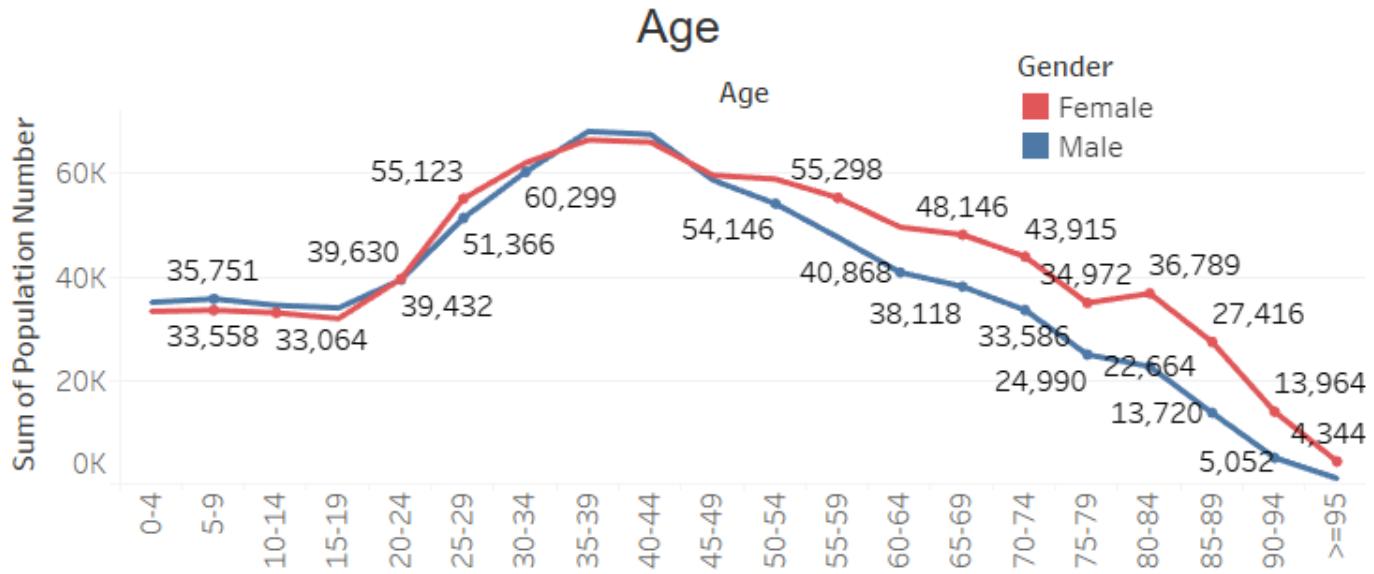
5.2.5 Population by District



A map is used to identify the population living in each Barcelona district. The more intense the color the more populated the

district is. Moreover in the chart is included a *select action* which allows to filter the whole dashboard by a single district, this will help to analyze faster by only one district than using the filter in the top left of the dashboard

5.2.6 Age



This chart consists of two line plots, one per gender (pink: female, blue: male), analyzing the ages distribution of the citizens of Barcelona. In addition a *filter action* is added in this plot that will allow to filter some of the chart in the dashboard (Population, Population by Year and Population by district) by the age.

5.3 Life Quality Dashboard

Figure 1: Life quality dashboard with table

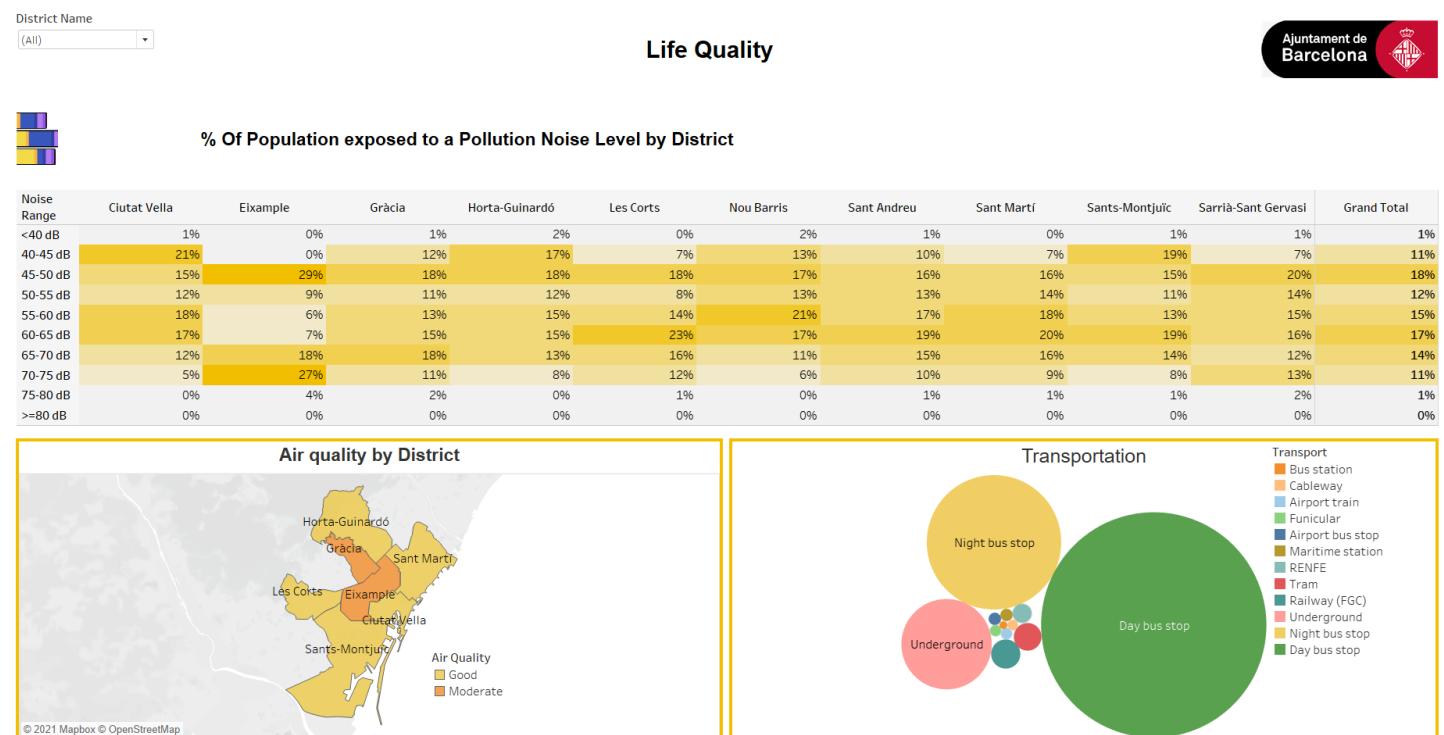
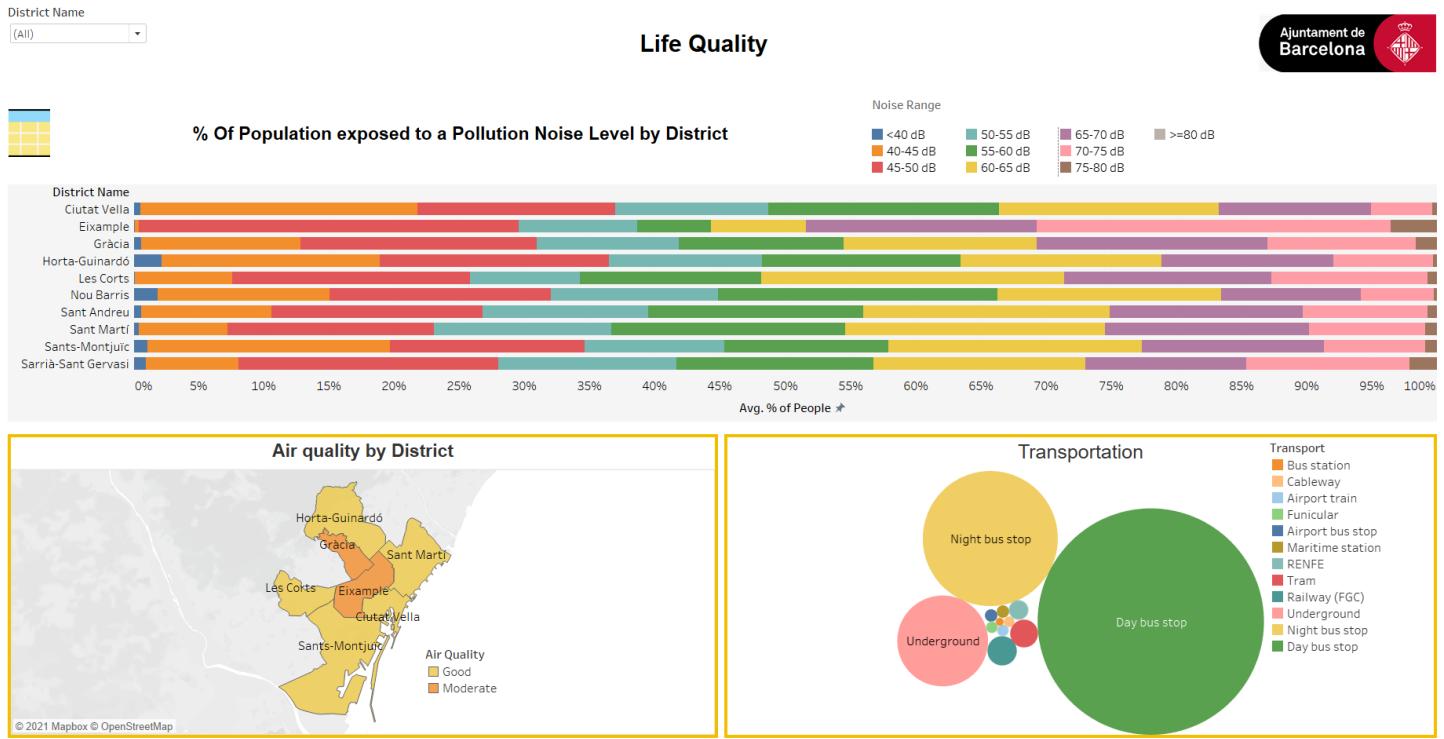


Figure 2: Life quality dashboard with 100% stacked bar chart



This dashboard has the goal to analyze the quality of life in the city, looking on noise pollution, quality of the air and transportation.

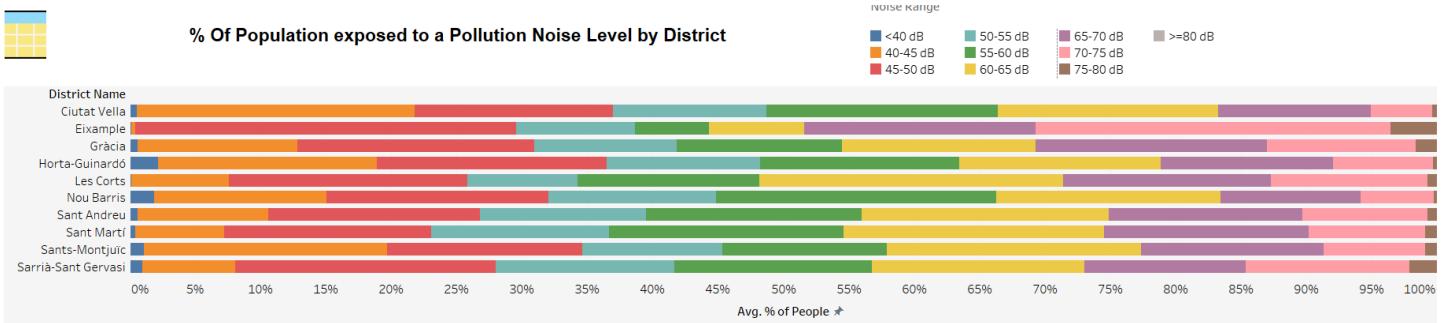
In this dashboard there are three (maybe four) charts, one drop down menu, used to filter all the charts by the district, the classical Button in the city logo to go back in the overview dashboard and a new button that in the beginning takes the shape of a barchart and then, when clicked, it changes the table chart into a 100% stacked barchart and it changes into a table logo to go back to the table.

This particular decision to switch between two different charts has been taken since people thought can be generally divided into 2 groups: analytical (which will be more satisfied by looking at numbers) and sensible (which can be easily impressed by the colors).

5.3.1 % Of Population exposed to a Pollution Noise Level by District

This section shows a table of data corresponding to the stacked bar chart above.

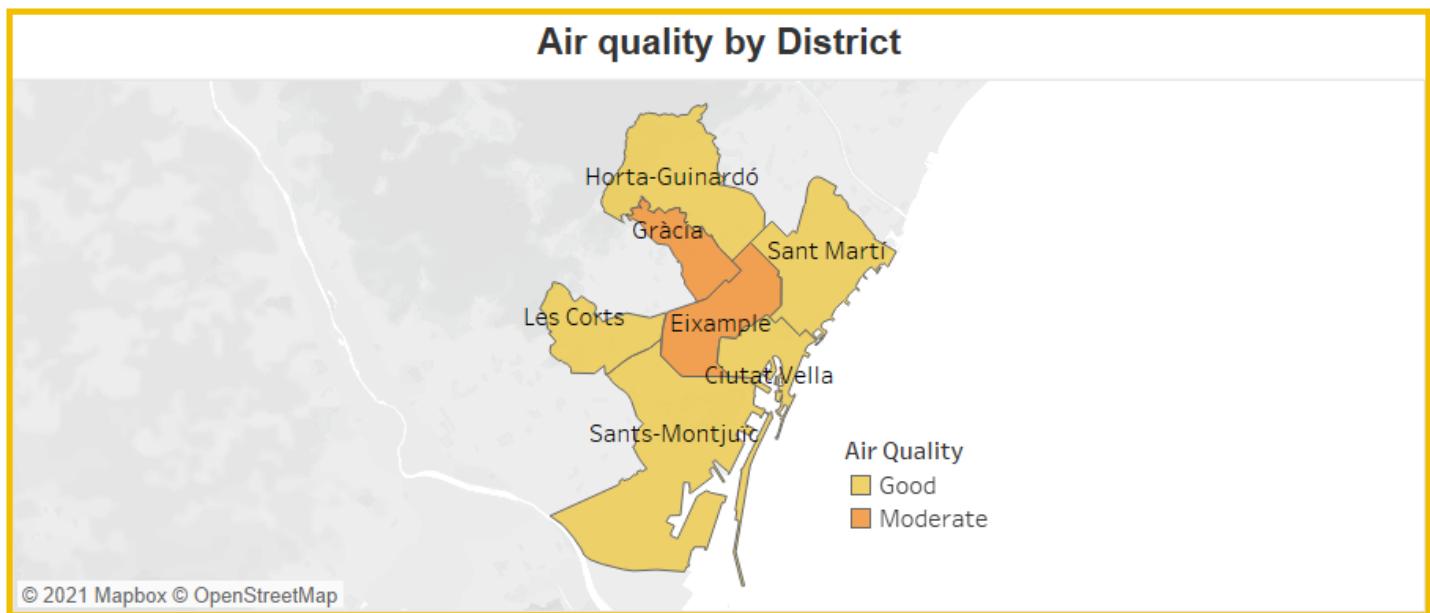
Noise Range	Ciutat Vella	Eixample	Gràcia	Horta-Guinardó	Les Corts	Nou Barris	Sant Andreu	Sant Martí	Sants-Montjuïc	Sarrià-Sant Gervasi	Grand Total
<40 dB	1%	0%	1%	2%	0%	2%	1%	0%	1%	1%	1%
40-45 dB	21%	0%	12%	17%	7%	13%	10%	7%	19%	7%	11%
45-50 dB	15%	29%	18%	18%	18%	17%	16%	16%	15%	20%	18%
50-55 dB	12%	9%	11%	12%	8%	13%	13%	14%	11%	14%	12%
55-60 dB	18%	6%	13%	15%	15%	14%	21%	17%	18%	13%	15%
60-65 dB	17%	7%	15%	15%	23%	17%	19%	20%	19%	16%	17%
65-70 dB	12%	18%	18%	13%	16%	11%	15%	15%	16%	14%	14%
70-75 dB	5%	27%	11%	8%	12%	6%	10%	9%	8%	13%	11%
75-80 dB	0%	4%	2%	0%	1%	0%	1%	1%	1%	2%	1%
>=80 dB	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%



These two charts show exactly the same information but in a really different way. The table has the districts as columns, the noise pollution level as rows and each cell contains the percentage of people in a district exposed to a certain pollution level.

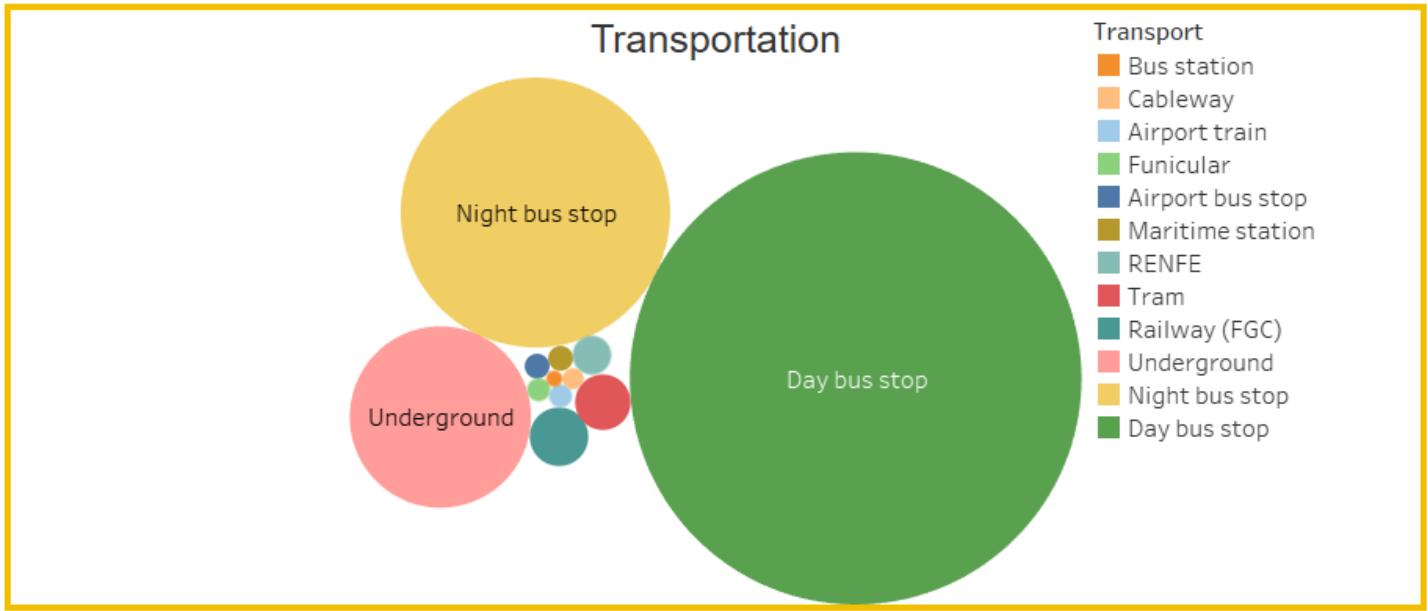
On the other hand the other plot is composed by ten bars, one for each district and it is composed by the percentage of people exposed to a certain pollution level, the pollution level is identified by the colors.

5.3.2 Air quality by district



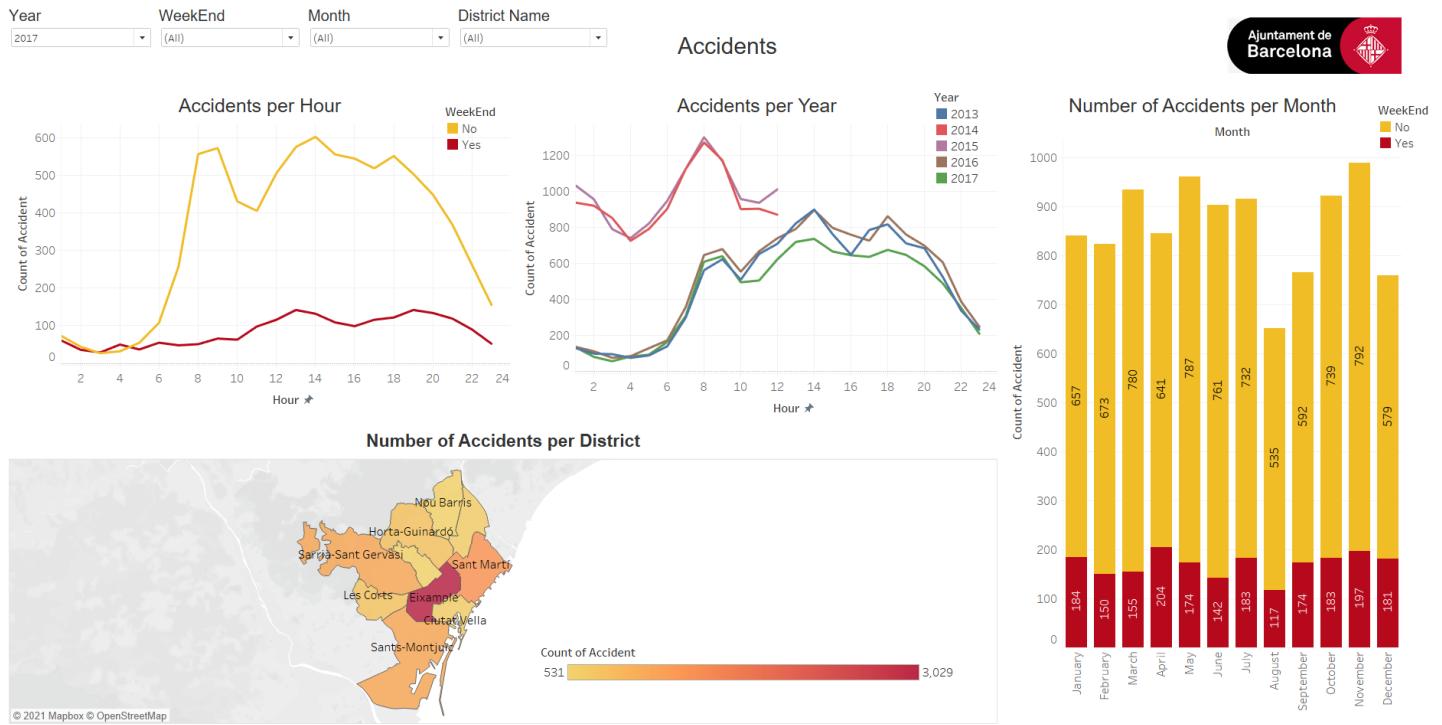
In this visualization a map is used to visualize what is the worst air quality relieved in the year 2017, in addition an action filter was added in order to easily analyze all the other charts in the dashboard.

5.3.3 Transportation



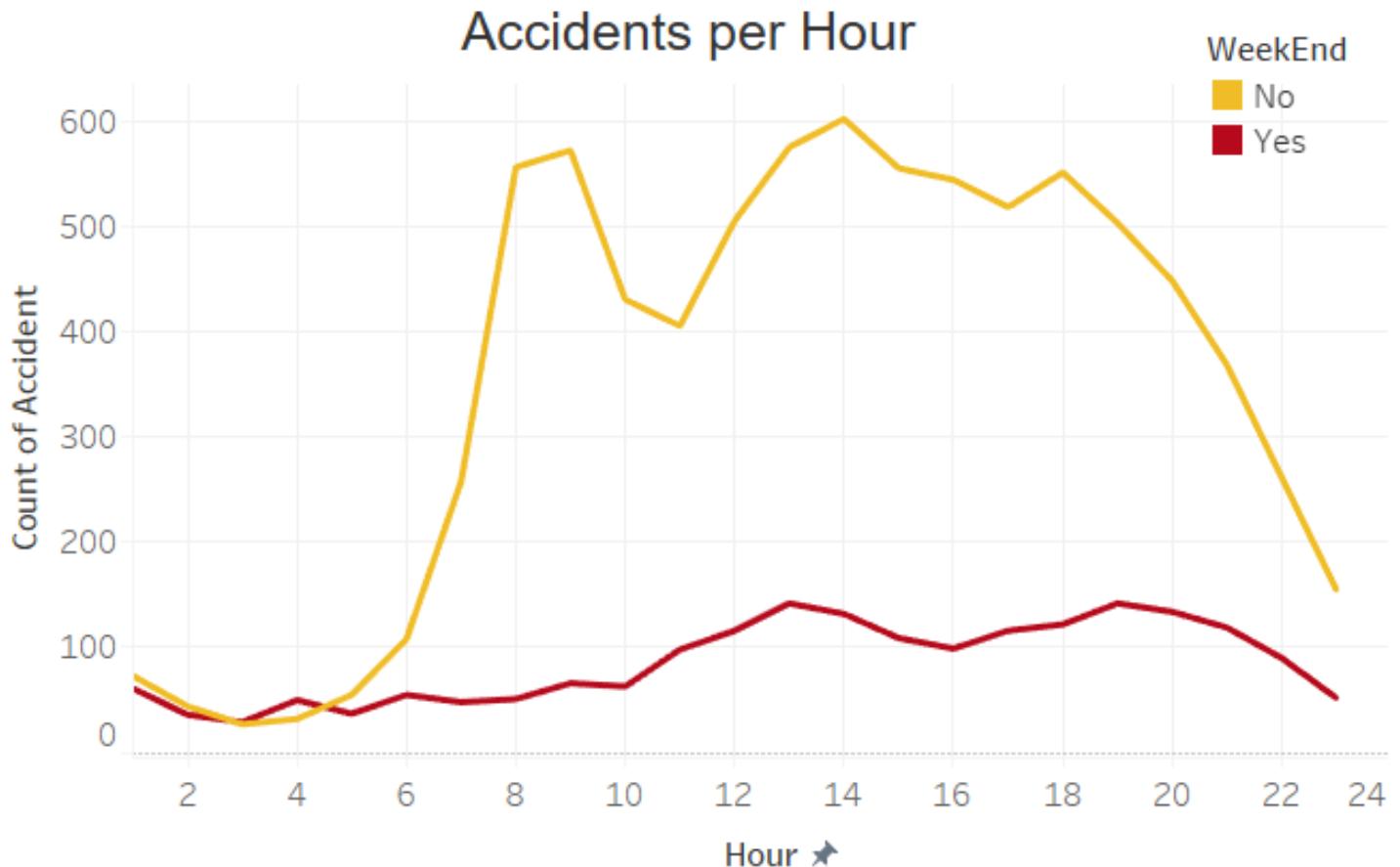
This bubble chart analyzes the quantity of vehicles for the different types of transportation, where the size of each bubble is identified by that quantity (the bigger the bubble the more vehicles of that type are available).

5.4 Accidents Dashboard



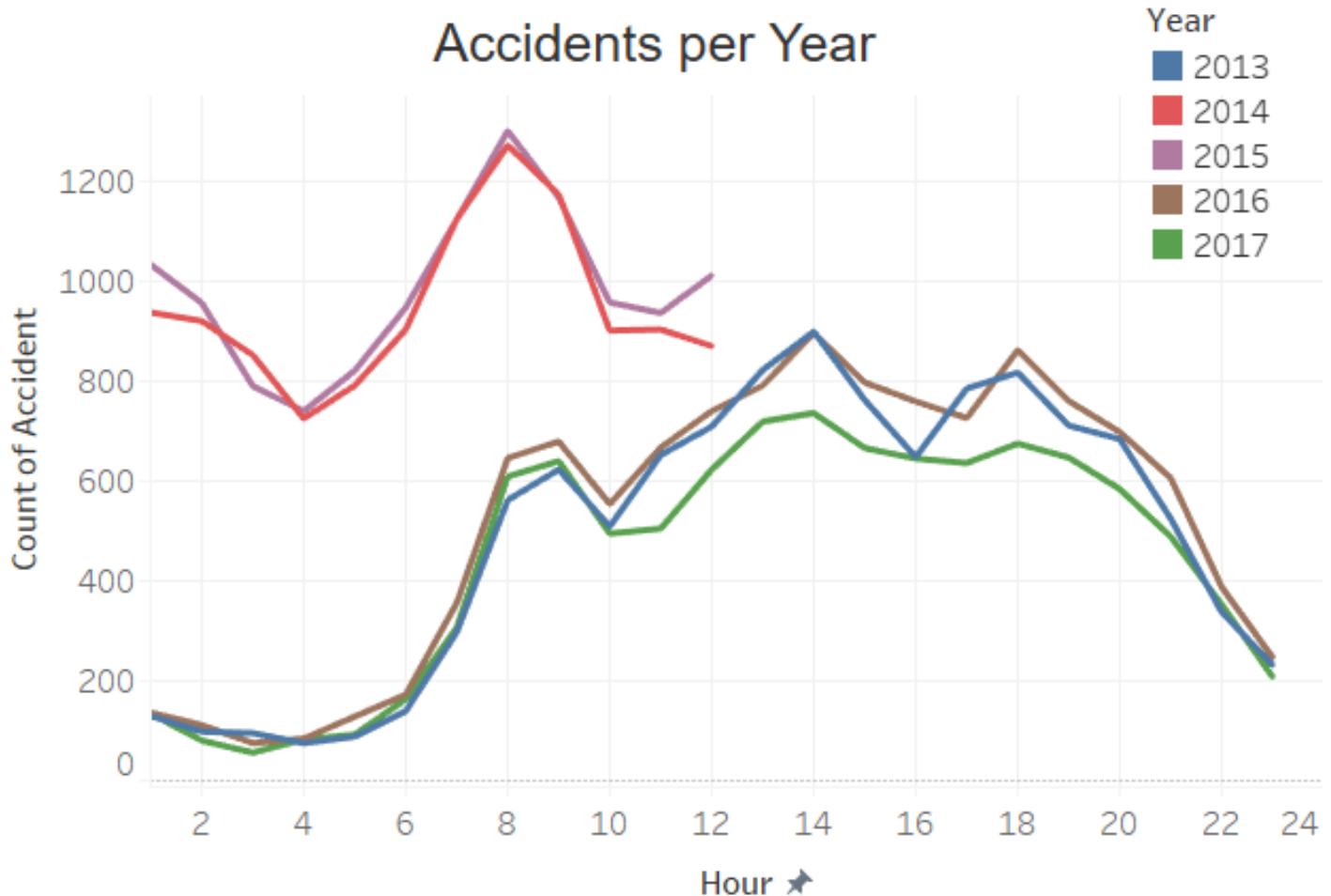
The Accidents Dashboard has the main goal to give a clear understanding of the accidents that happen in Barcelona. In this dashboard there are four drop down menu which will filter the whole dashboard by year, WeekEnd (or not weekend), month and district name respectively (from left to right), then there is the classic button under the city logo to go back into the overview dashboard. Then there are four charts that will be analyzed more in detail in the following sections.

5.4.1 Accidents per Hour



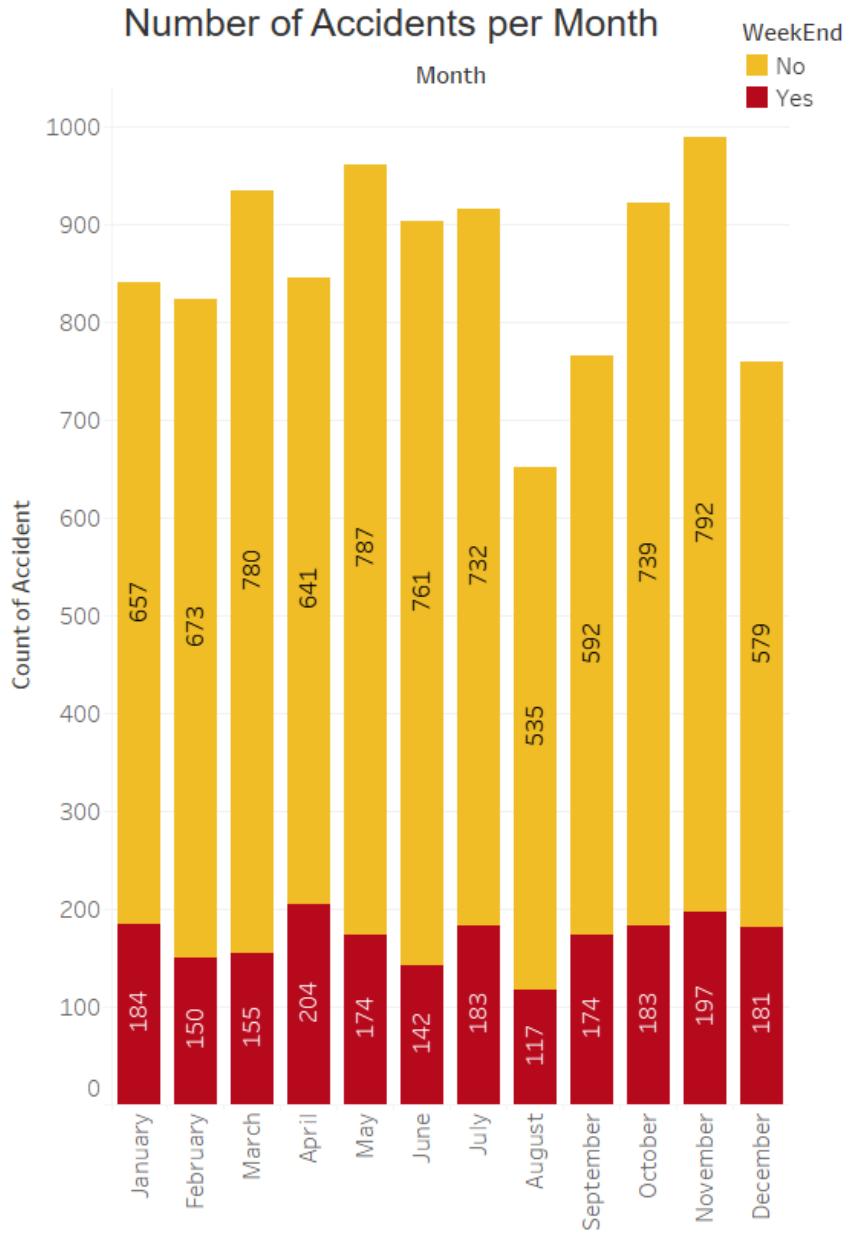
The accidents per hour visualization is a line chart that identify how the accidents of a particular year are distributed during the day hours, with a further separation between the weekend and the work days.

5.4.2 Accidents per Year



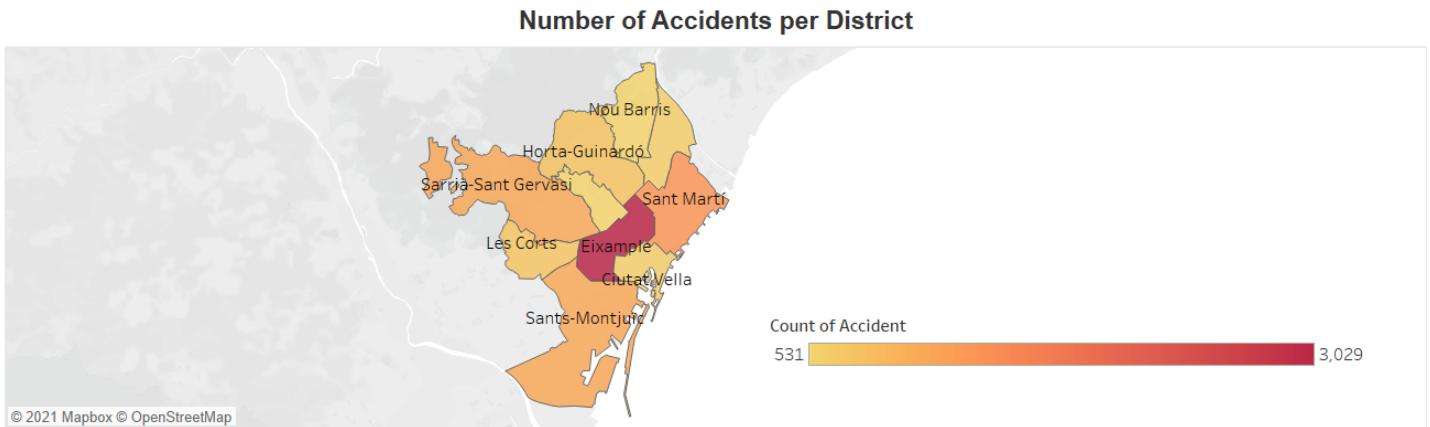
This visual allows to give a direct look in how the accidents distribution is changed over the years. It follows the same reading schema of the previous visual but without making the direct distinctions between the week day type (weekend or not weekend).

5.4.3 Number of accidents per Month



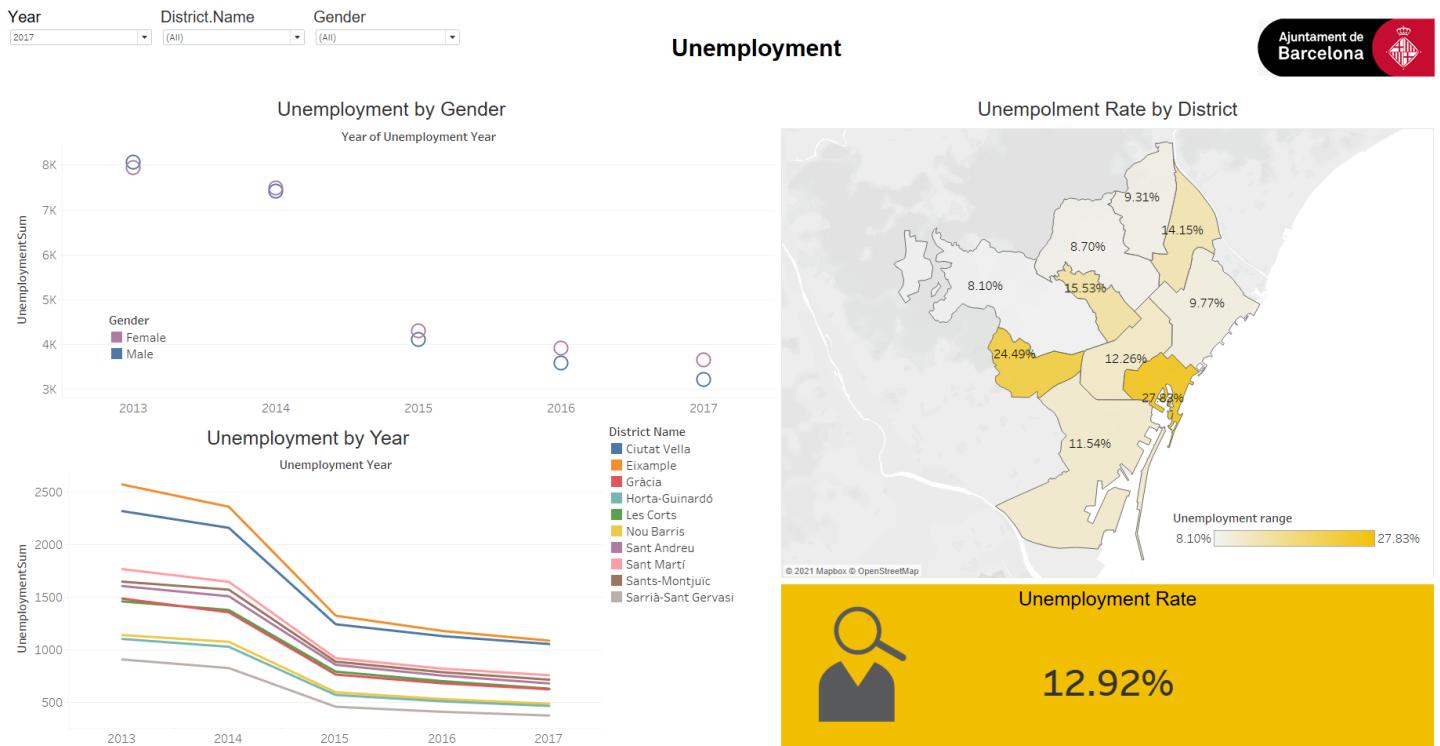
this chart shows the relationship between months and number of accidents, broke by the weekend measure. It follows the idea of the previous graphs but it is implemented in a different way, the usage of a stacked bar chart instead of a line plot allows to the final user to specifically identify the situation in a certain month of interest, but also giving a general (but less smooth) understanding of the overall situation.

5.4.4 Number of Accidents per District



In this visualization a map is used to visualize the amount of accidents per each district in the situation selected by the drop down filters. The amount of accidents could be identified by the intensity of the color of each district (light yellow to dark red)

5.5 Unemployment Dashboard



The unemployment dashboard will focus only in analyzing the employment situation of the city, going in detail among the always frustrating difference in employment by the gender, but also will be analyzed how the unemployment rate is changed over the years and how it changes between the districts of Barcelona.

Also this dashboard is composed by three filters set up inside three different drop down menu and the classic home button in the Barcelona city logo.

As you will see, in this dashboard a particular indicator is used, the **Unemployment Rate**, calculated as the ratio between the number of unemployed people in the situation identified by the filters divided by the total amount of force labour (people in age range 15-64 years old). For this measure were considered not only people that officially result as unemployed, but

also the people that asked for a unemployed status, since these are still people that don't have a job and then for a possible migrant in the city can be considered as an unemployed too.

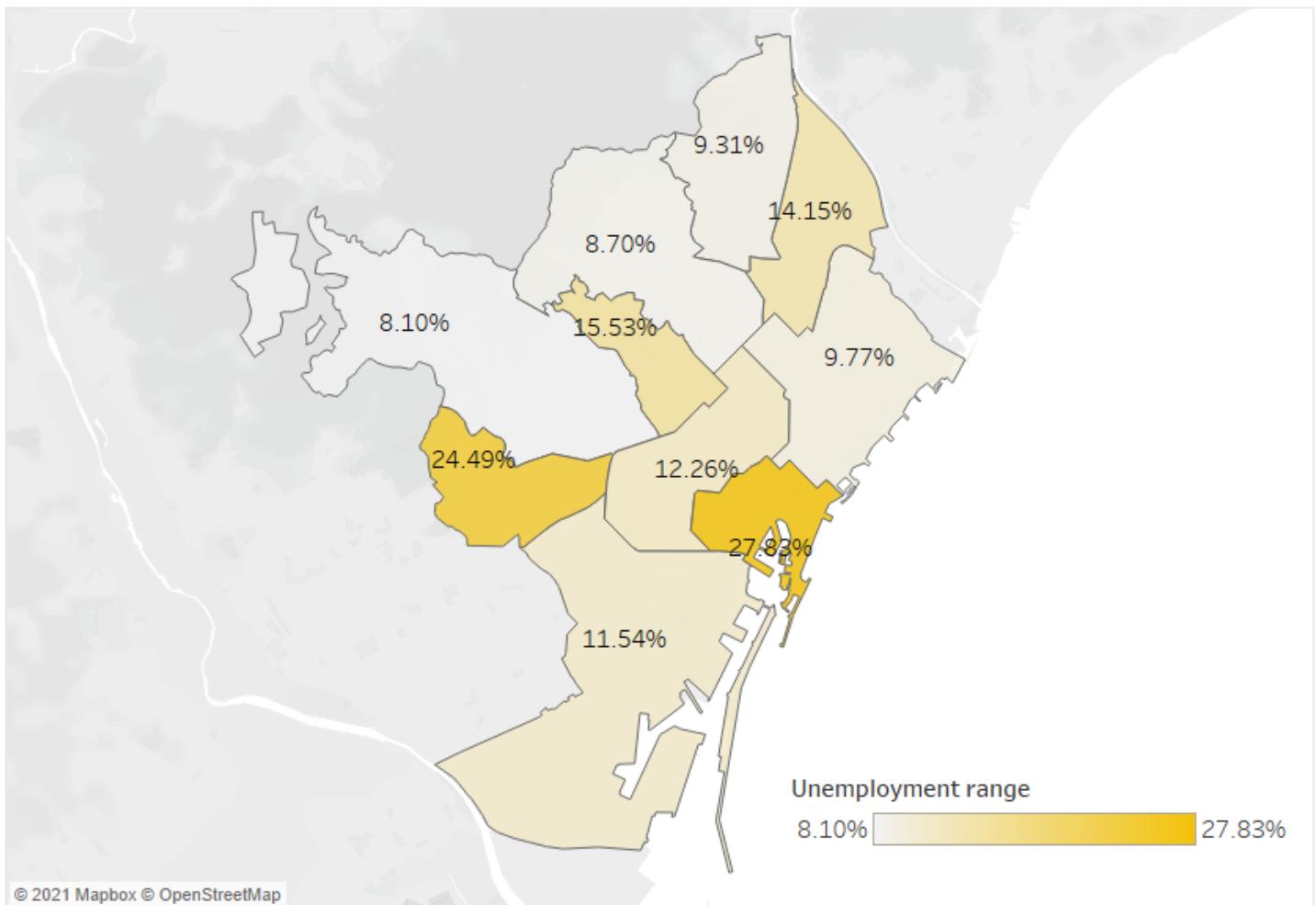
5.5.1 Unemployment by Gender



This plot has been main with the main goal of identifying in a direct way how much the number of unemployed people changed by the different genders over the years. To accomplish that a scatter plot with circular shapes has been made in order to have a fast recognition on the selected situation.

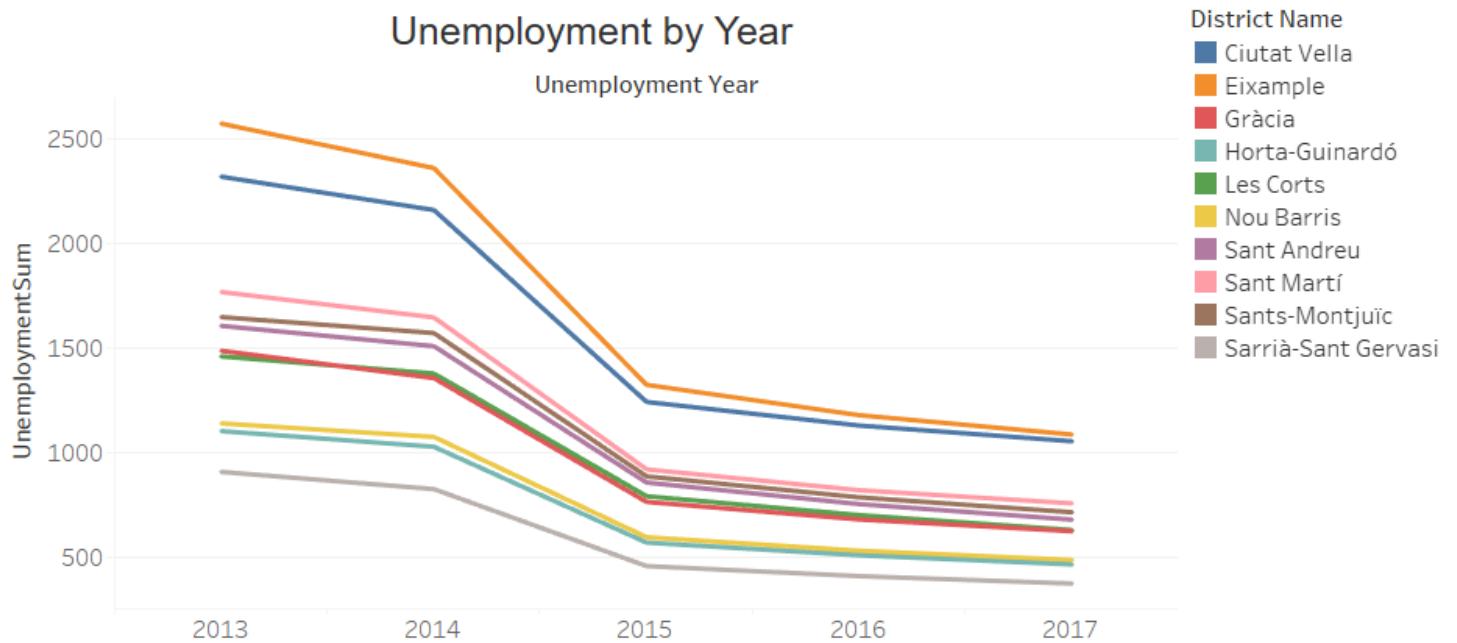
5.5.2 Unemployment Rate by District

Unempolment Rate by District



To show how the unemployment rate change across the different districts a map was made, the unemployment rate can be read in the single districts and can also be identified by the intensity of the color. In addition to that a filter action is added to that visual, in order to easly filter all the charts in the dashboard for a single district.

5.5.3 Unemployment by Year



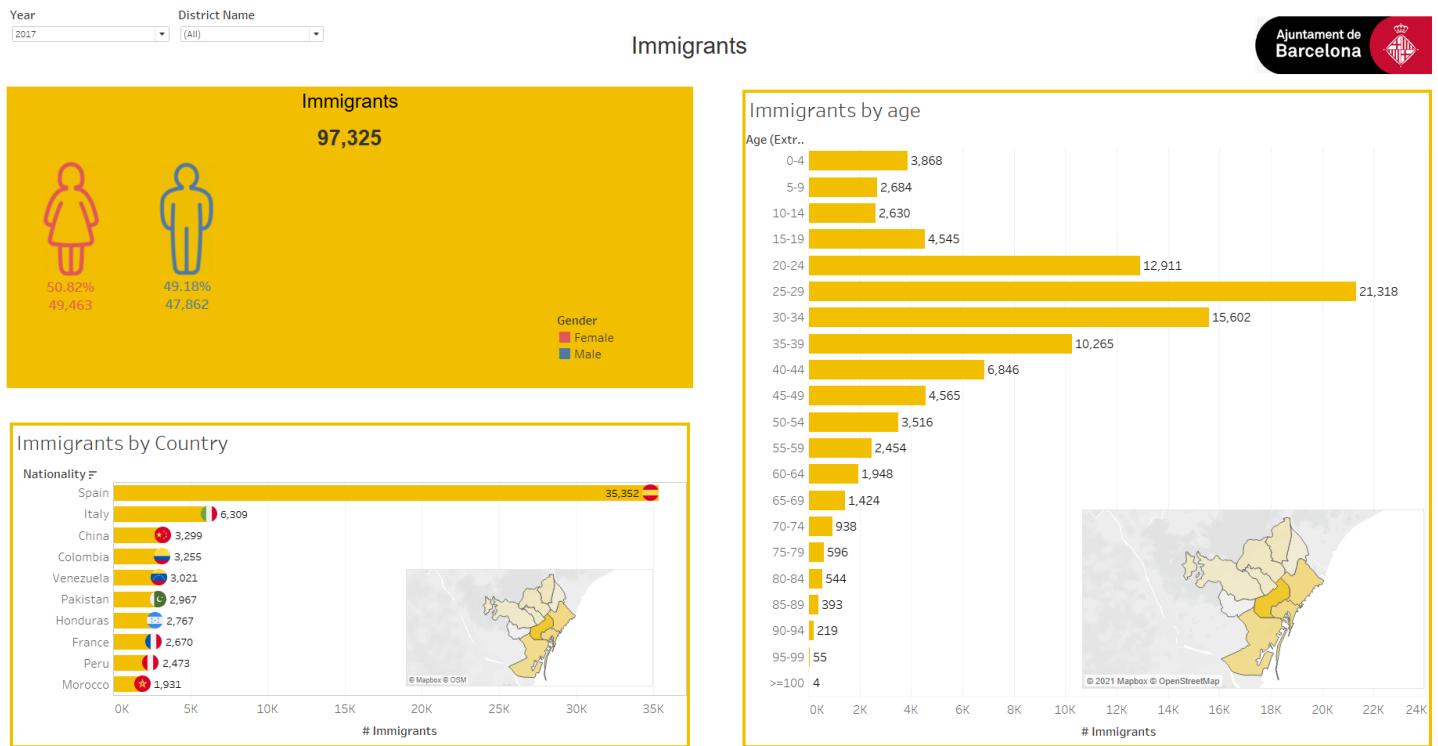
This visualization consists in a set of 10 different line charts plotted in the same axis, in which each line identify how the unemployment changed over the years for a single district. A legend for district names in the right corner helps to identify what color is related to what district.

5.5.4 Unemployment Rate



This KPI shows the percent rate of unemployment related to selected year.

5.6 Immigration Dashboard



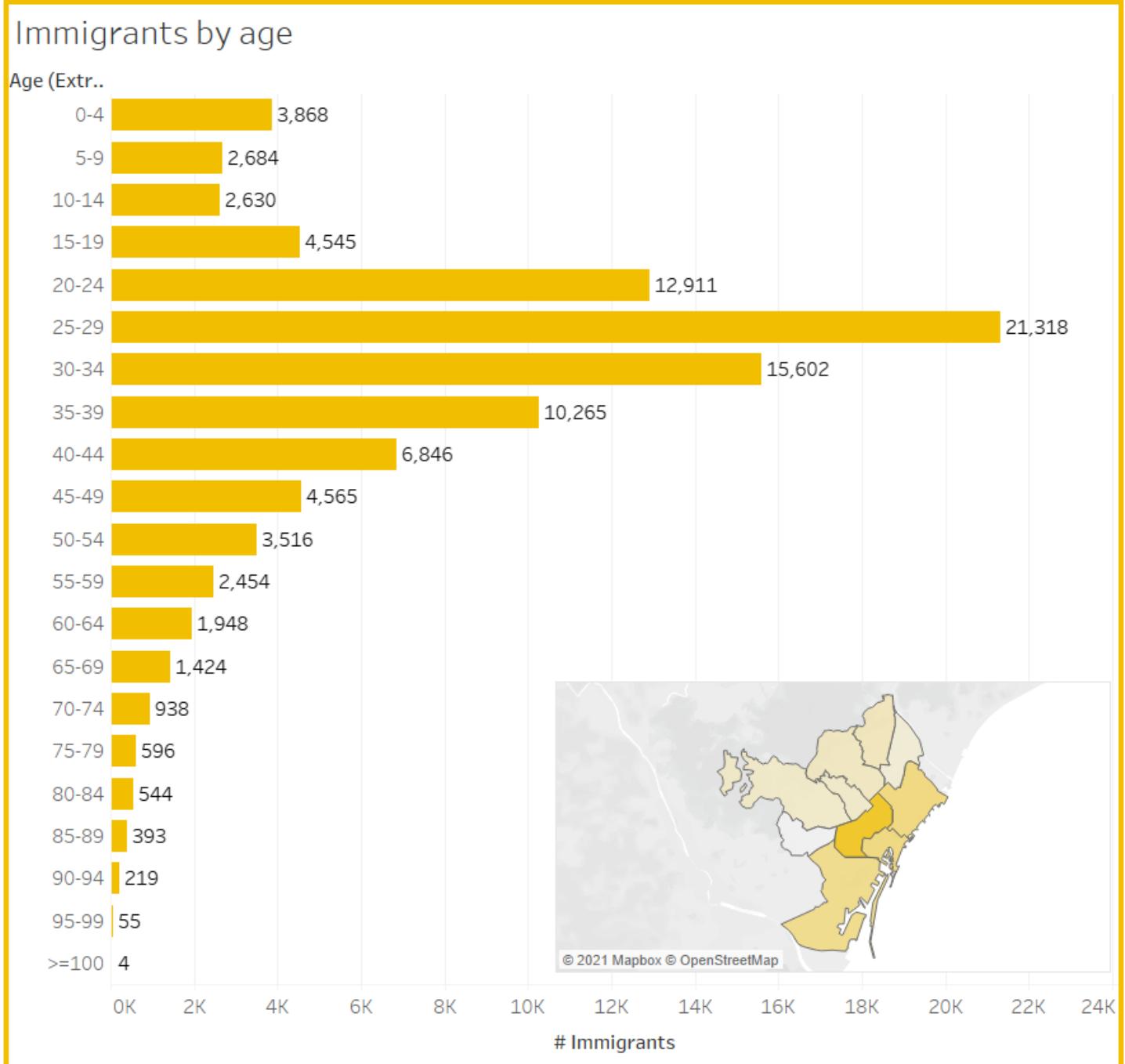
The immigration dashboard is composed by only three charts, two drop down menu (filters) and the usual home button. It's goal is to give information about people who decided to move into Barcelona.

5.6.1 Immigrants



This chart is a KPI showing both the number of immigrants in the city and how they are distributed by their gender.

5.6.2 Immigrants by Age

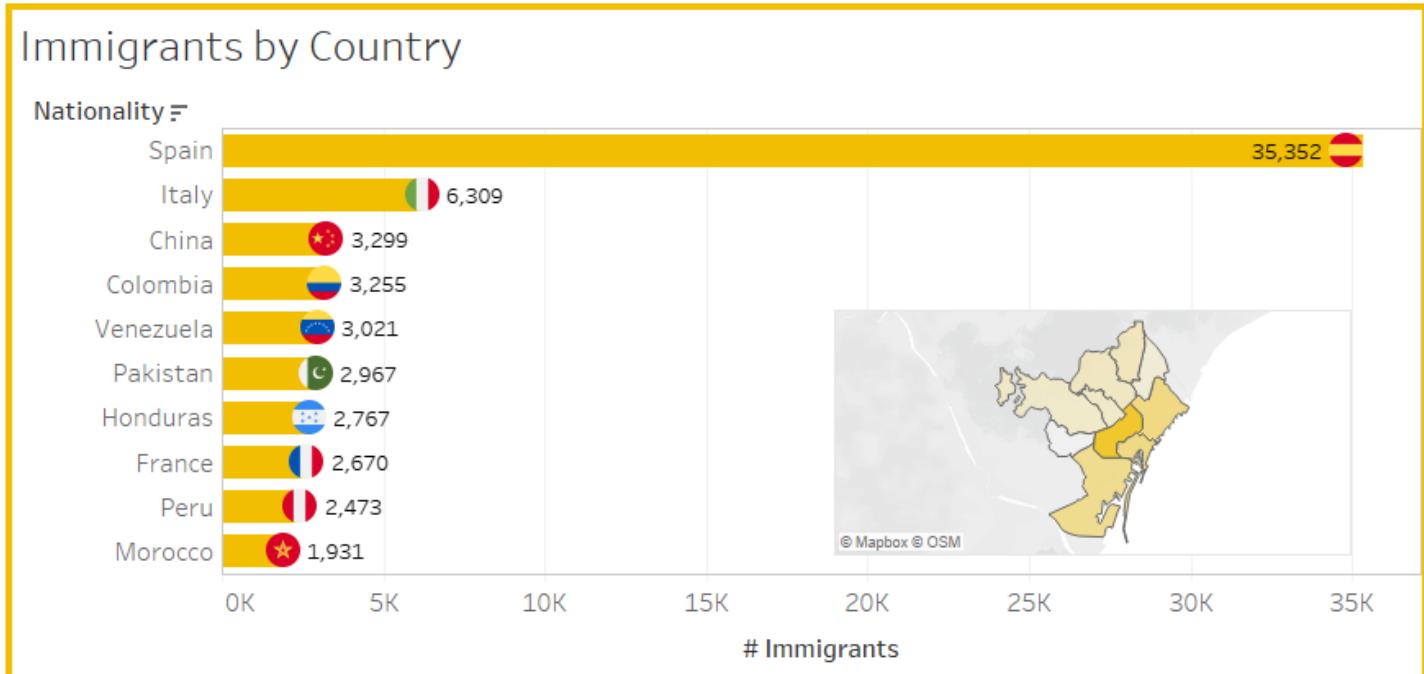


This chart is composed by two parts:

1. A bar chart: showing how the immigrants are distributed by their age
2. A map: showing how the immigrants are distributed according the district

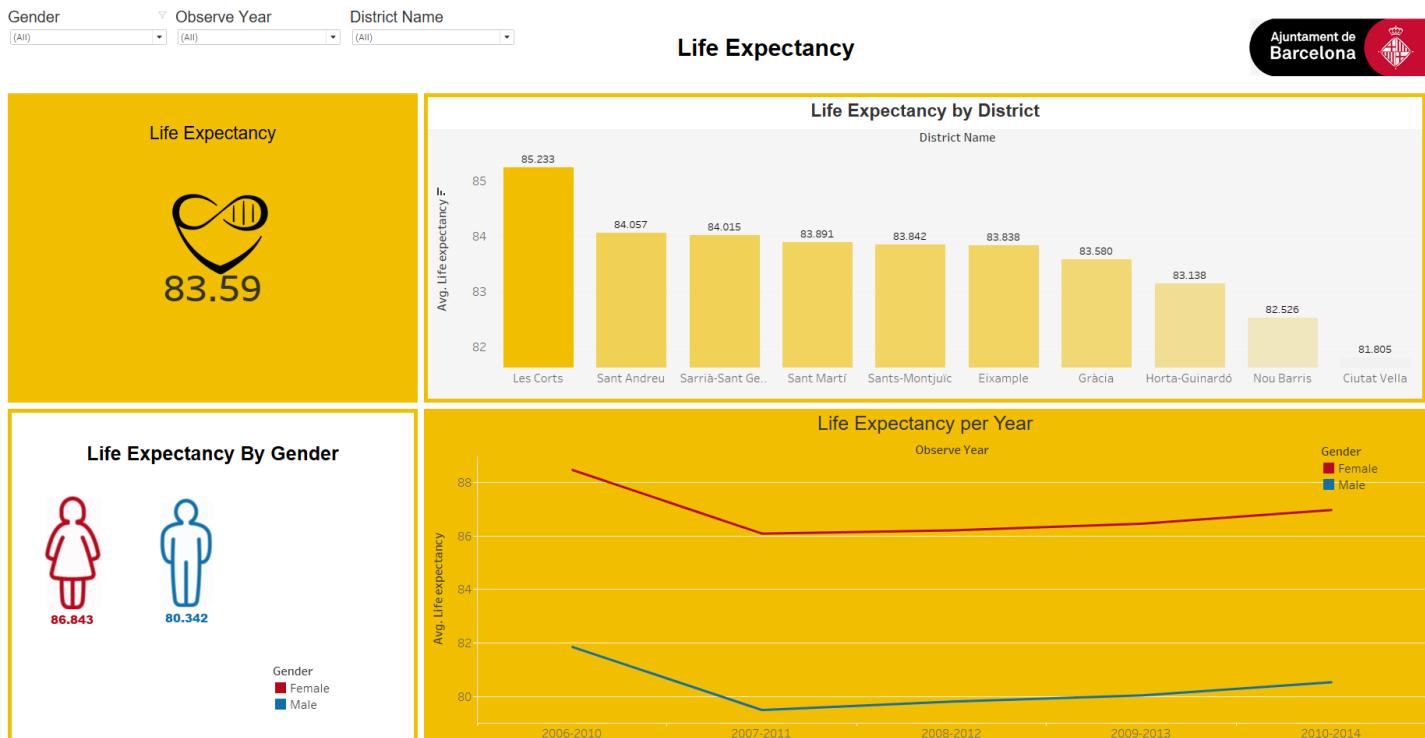
This particular choice was made in order to allow the user to analyze how the immigrants are distributed by their age in the various districts and vice versa.

5.6.3 Immigrants by Country



Similar to the previous visualization, here, the number of immigrants by each nationality have been calculated. To the aim of better visualization, this data filtered to show only the top 10 nationalities along with the number of immigrants. The map was also added to easily investigate the distribution of the immigrants in each district by their nationality.

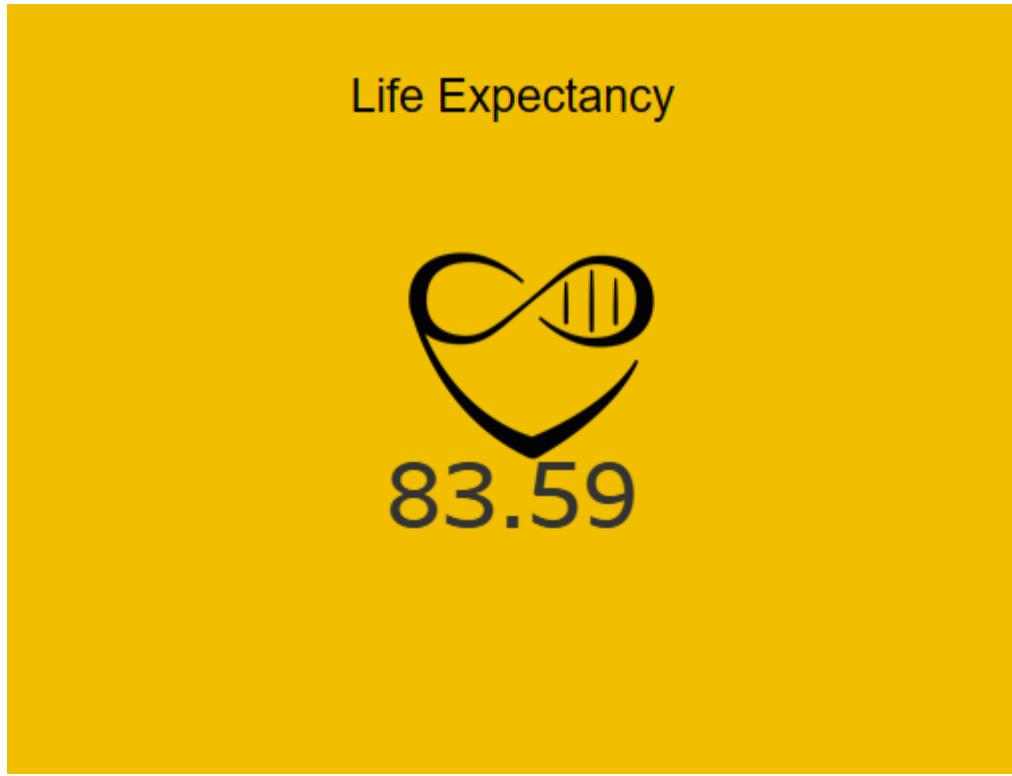
5.7 Life expectancy dashboard



This dashboard will focus in analyzing the life expectancy in Barcelona under various aspects like the gender and the districts

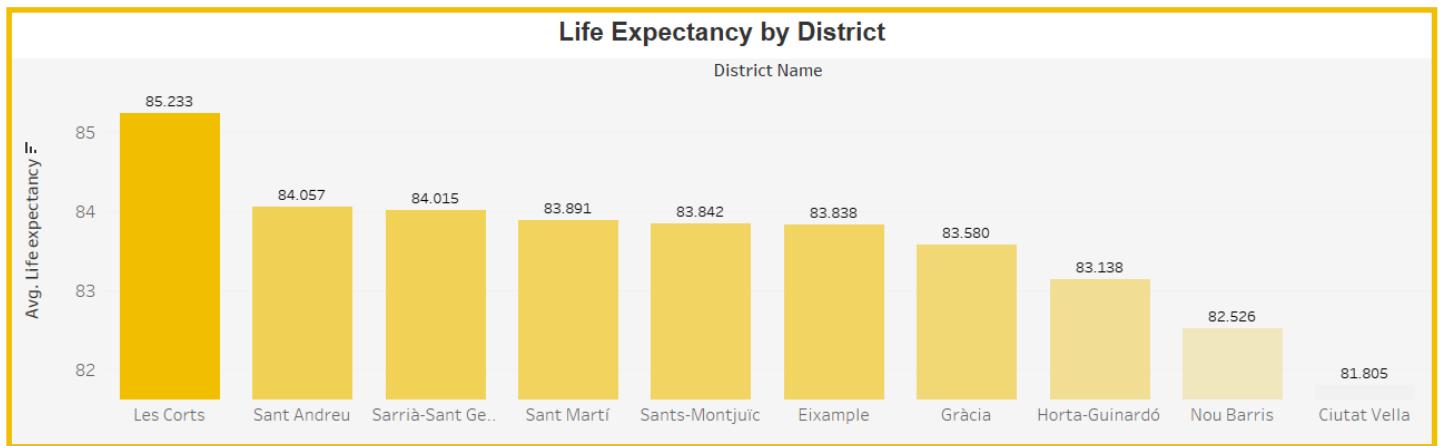
and will also analyze how this changed over the years. It follows the classical configuration of all the other dashboards by using the drop down menu as filters and the home button.

5.7.1 Life Expectancy



This is a pretty simple KPI showing the average life expectancy of the situation identified by the filters.

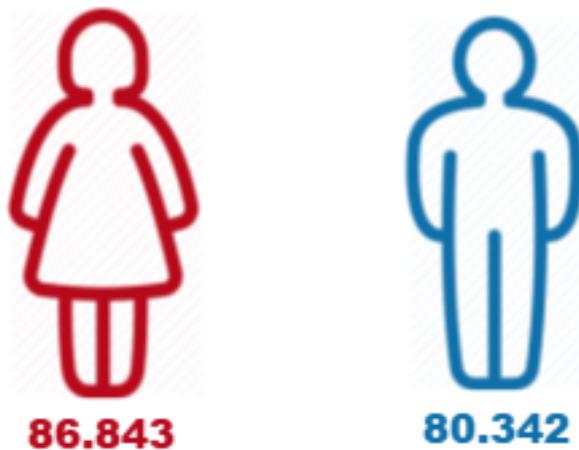
5.7.2 Life Expectancy by District



This is a bar chart identifying the life expectancy in each district, the life expectancy can be identified by both the label on the top of each bar and from the intensity of the color. In addition the districts were ordered in decreasing order according to the life expectancy, hence also the position can be used to identify the information.

5.7.3 Life Expectancy by Gender

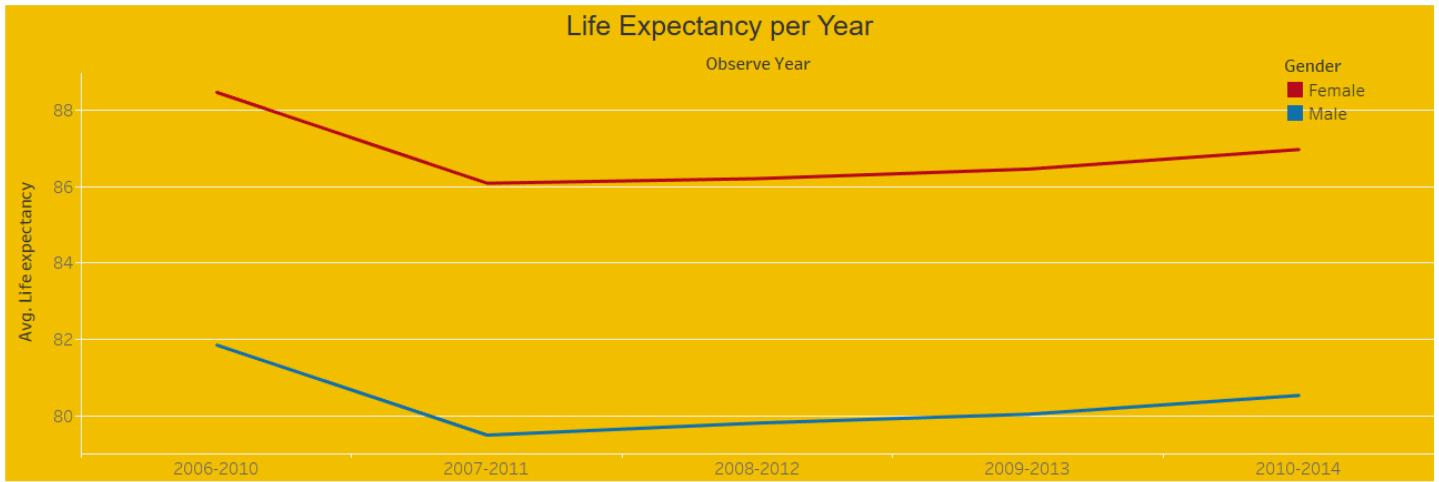
Life Expectancy By Gender



Gender
■ Female
■ Male

This chart shows how the life expectancy changes by the gender, it can be identified by the digits below each figure and by the size of the figures.

5.7.4 Life Expectancy by Year



This chart is composed by two lines, one per each gender and shows how the life expectancy changed over the years.

6 Conclusions

This report aims to analyze the composition of Barcelona under various aspects. Through the analysis carried out, it is possible to answer the initial business questions.

In the following sections all the Business questions will find an answer.

6.1 Demographic questions

6.1.1 How many people live in Barcelona and how is the distribution of these people in districts?

This question can be answered by looking at the **population by Year** line chart and at the map **Population by District** in the Demographic dashboard.

Barcelona population is assessed in approximately 1.6 Millions of people and is distributed in approximately equal way among all the districts except for *Eixample, Sant Martí* districts that have the highest concentration of population and with *Les Corts and Ciutat Vella* that are the least populated districts

6.1.2 How did population change during years divided by gender?

This question can be answered by looking at the **Population KPI**, which identify that population is always have been pretty well distributed across the two gender, with a little prevalence of girls.

6.1.3 Do people tend to have children?

To answer at this question the **Birth by Year** line chart can be studied, in which can be seen that the number of births is generally increasing with the years, even if there is a reduction in births for the year 2017 the trend is still increasing.

6.1.4 How is the distribution of age of population?

By looking at the **Age** line chart can be seen that the population in generally is at their mid ages, with a reduced number of young people (age lower than 25) and an even low number of older people (age higher than 70).

6.1.5 How death is distributed across the age?

The distribution of deaths across the population age is quite good, with deaths near to 0 for younger people and with a peak of deaths for an really high age, this can be seen in **Deaths by Age** plot

6.2 Life Quality questions

6.2.1 At which level of noise pollution I can expect to live?

From both the table and the 100% stacked barchart can be seen that the 57% of the citizen of Barcelona live in zones with a noise pollution level lower than 60 dB, that is the noise level of a normal conversation or of a background music.

6.2.2 What is the air quality of the districts?

Thanks to the **Air quality by District** map can be seen that almost all the districts have a good air quality level except for **Gracia** and **Eixample** districts in which is only moderate.

6.2.3 Which transportation is more accessible in the city?

As can be seen in the **Transportation** bubble chart, the most common transportation is the bus, both Daily bus and Night bus, but also the Underground transports are pretty common.

6.3 Immigration questions

6.3.1 What is the number of immigrants in Barcelona?

Barcelona counts almost 100,000 Immigrants each year, divided in a pretty equal way between males and females. This statement can be confirmed by the **Immigrants** KPI.

6.3.2 What is most frequent nationality in Barcelona?

Thank to **Immigrants by Country** chart, can be seen that the majority of the immigrants are Spanish, then followed by Italians. The other nations count almost the same amount of immigrants in the city.

6.3.3 At what age people tend to migrate more to Barcelona?

From the **Immigrants by Age** bar chart can be seen that people, in general, tends to move into Barcelona into their mid twenties or in their early thirties.

6.4 Accidents questions

6.4.1 In what hour number of accidents are higher?

Thanks to the plot **Accidents per Hours** can be seen that the most dangerous hours to drive are the ones in which people tends to travel to go/come from work (8AM, 2 PM and 6PM).

6.4.2 Is the number of accidents different at weekends?

The trends seen before seems to fit also for weekends, without the morning peak.

6.4.3 Is the number of accidents changed over the years?

In the multiple line chart **Accidents per Year** can be seen that in general the city is becoming safer, with the number of accidents reducing across the years.

6.4.4 In which month number of accidents are higher?

Thanks to the **Number of Accidents per Month** we can see that the accidents seems not to be correlated with the months, in which we have approximately the same amount of accidents, except for August, September and December in which the number of accidents is really lower.

6.4.5 In what district more accidents happen?

The most dangerous district is **Eixample**, which is also one of the most populated districts and one of those with a moderate air quality, making this district one of the worst for moving into it.

6.5 Unemployment questions

6.5.1 What is the unemployment rate in Barcelona?

The Unemployment rate in Barcelona is about at 13%.

6.5.2 How did the unemployment rate change during the years?

The unemployment rate is decreased for the latest 5 years, suggesting that it will continue decreasing.

6.5.3 Does Women have an higher unemployment rate than men?

To answer to this questions there the **Unemployment by Gender** can be used, in which can be seen that the number of unemployed women is tending to become higher than the number of unemployed men, instead talking about the unemployment rate the combination **Gender** filter and **Unemployment Rate** can be used, in which the situation remain confirmed with a slightly higher unemployment rate for women.

6.5.4 What district has a higher/lower unemployment rate?

To answer to this questions the **Unemployment Rate by District** map can be used, in which can be seen that the district with the lowest unemployment rate is *Sarrià-Sant Gervasi* and the district with the highest unemployment rate is *Ciutat Vella*.

6.6 Life Expectancy questions

6.6.1 How much is life expectancy in city of Barcelona?

In The city the life expectancy is arranged at about 83 Years.

6.6.2 Do women live more than men in Barcelona?

Thanks to the two plots **Life Expectancy By Gender** and **Life Expectancy per Year** it can be said that women tend to have a life expectancy of approximately 6 years higher.

6.6.3 How life expectancy change in each district?

Life expectancy across the districts is quite uniform and it is arranged at about 84 years except for *Nou Barris* and *Ciutat Vella* in which is lower than 83 years.

6.6.4 Is there a district with a better life expectancy?

The district with the best life expectancy is *Les Corts*, with more than 85 years of life expectancy.

6.6.5 How life expectancy changed during years?

Life expectancy had a drop in 2007-2011 years but then it started increasing again.

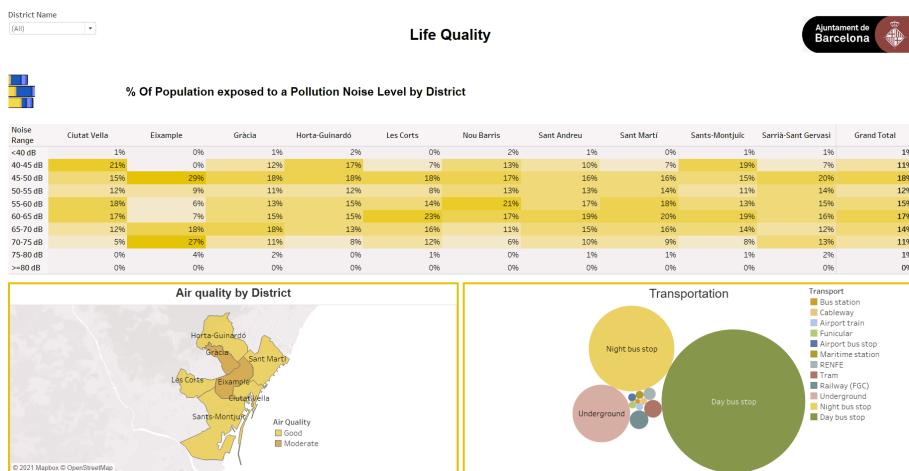
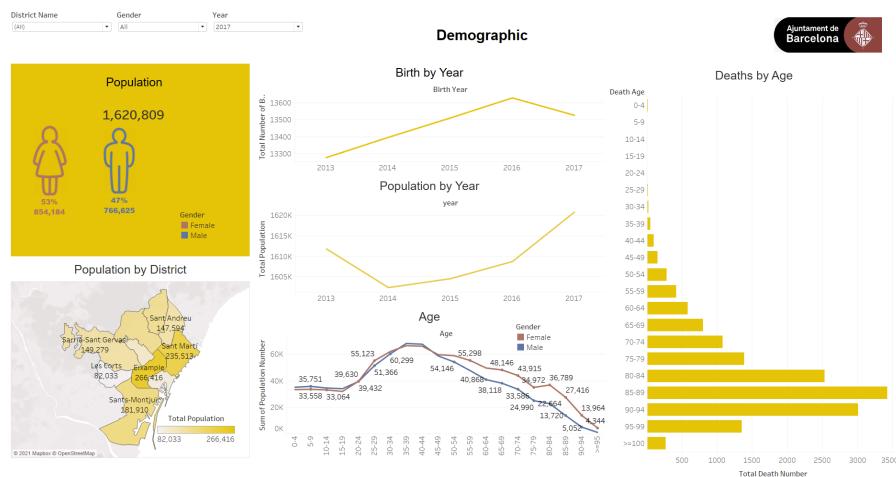
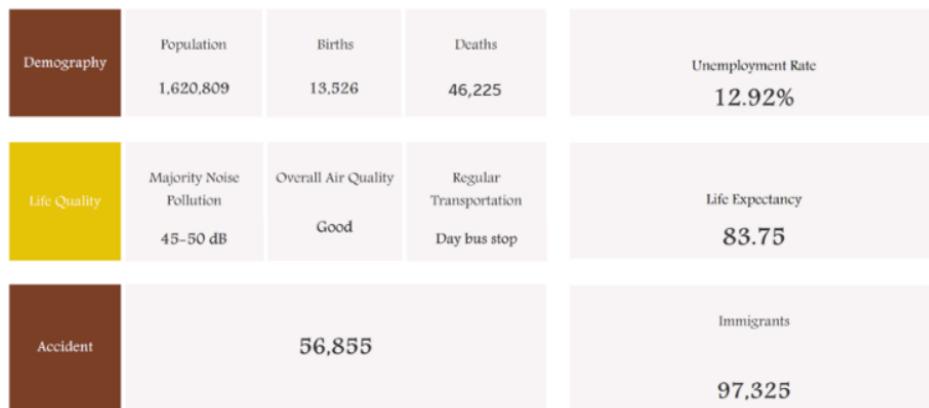
7 Color Blindness Test

For each dashboard, the color blindness test is carried out, in order to evaluate whether the dashboards achieved can be easily analyzed by people who have anomalies in the perception of colors.

The [Coblis](#) simulator was used

7.1 Protanomaly- Red weak

Overview



District Name
[All] ▾

Life Quality



% Of Population exposed to a Pollution Noise Level by District

Noise Range	Clotat Vella	Example	Gràcia	Horta-Guinardó	Les Corts	Nou Barris	Sant Andreu	Sant Martí	Sants-Montjuïc	Sarrià-Sant Gervasi	Grand Total
<40 dB	1%	0%	1%	2%	0%	2%	1%	0%	1%	1%	1%
40-45 dB	21%	0%	12%	17%	7%	13%	10%	7%	19%	7%	11%
45-50 dB	15%	29%	18%	18%	17%	16%	16%	16%	15%	20%	18%
50-55 dB	12%	9%	11%	12%	8%	13%	13%	14%	13%	14%	12%
55-60 dB	18%	6%	13%	15%	14%	23%	17%	16%	15%	15%	15%
60-65 dB	17%	7%	15%	15%	23%	17%	19%	20%	19%	16%	17%
65-70 dB	12%	18%	18%	13%	16%	11%	15%	16%	14%	12%	14%
70-75 dB	5%	27%	11%	8%	12%	6%	10%	9%	8%	13%	11%
75-80 dB	0%	4%	2%	0%	1%	0%	1%	1%	1%	2%	1%
>=80 dB	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Air quality by District

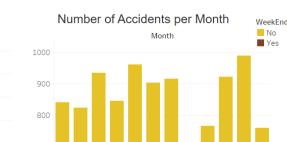
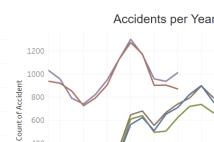
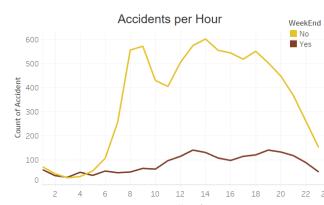


Transportation

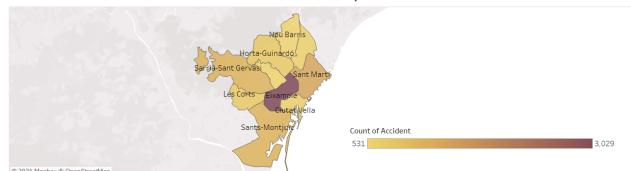


Year [2017] WeekEnd [All] Month [All] District Name [All]

Accidents



Number of Accidents per District

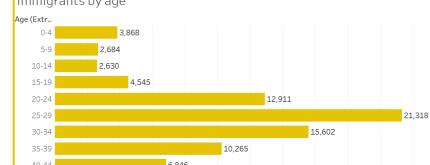


Year [2017] District Name [All]

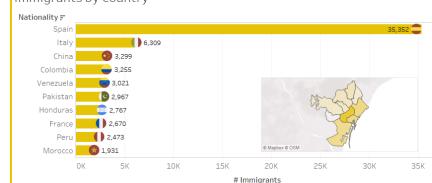
Immigrants

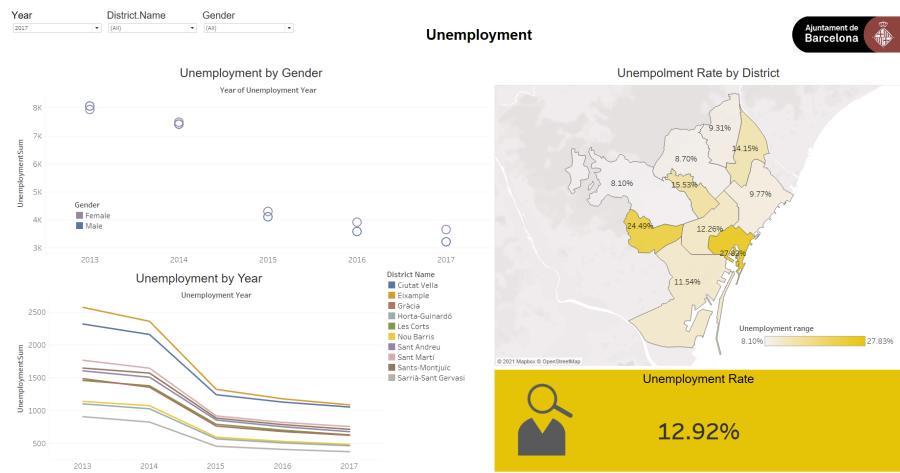


Immigrants by age



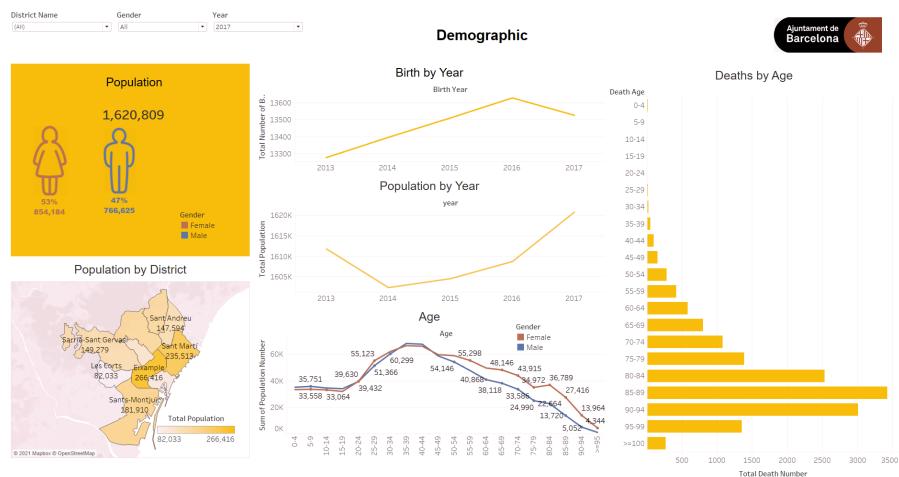
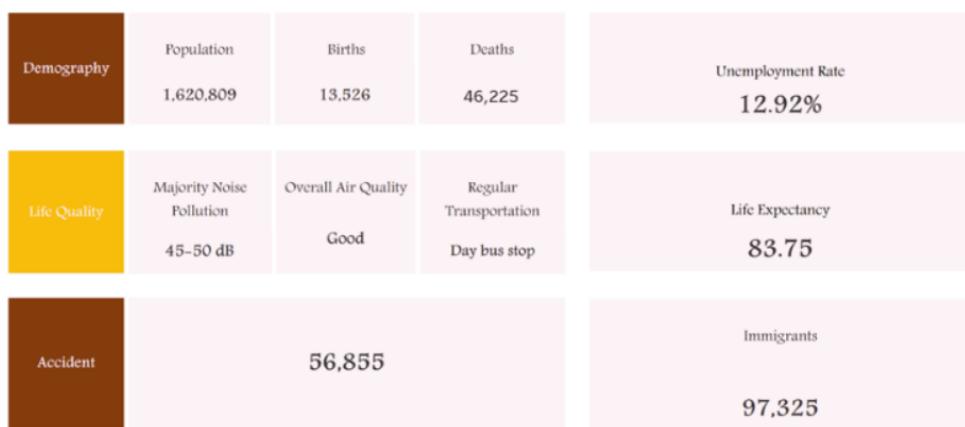
Immigrants by Country





7.2 Deuteranomaly- Green weak

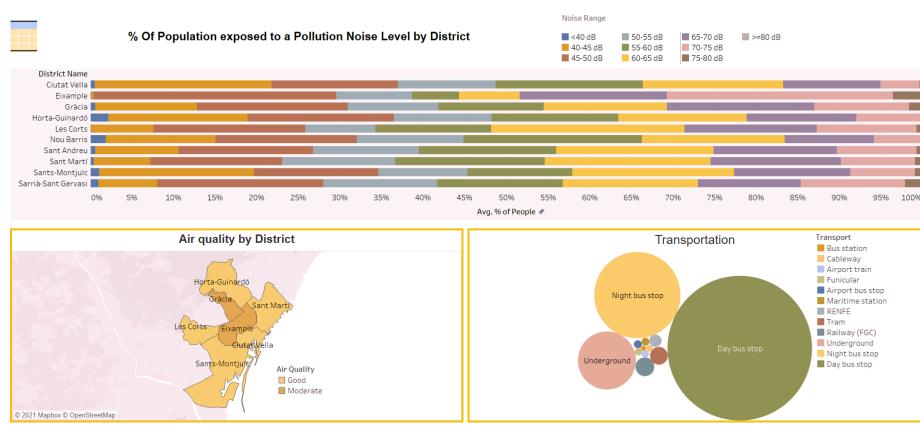
Overview



District Name
(All) ▾

Life Quality

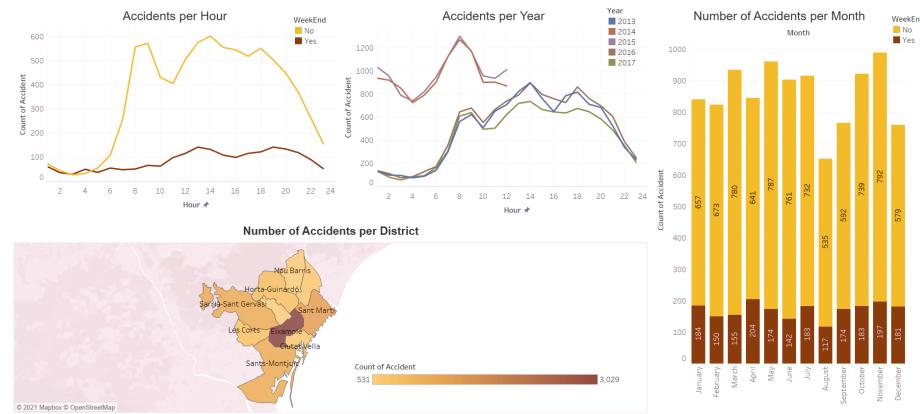
Ajuntament de Barcelona



Year
2017 ▾ WeekEnd
(All) ▾ Month
(All) ▾ District Name
(All) ▾

Accidents

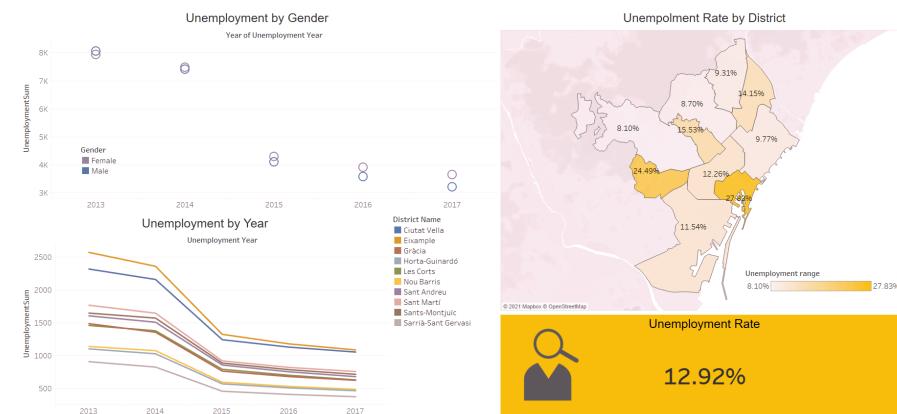
Ajuntament de Barcelona

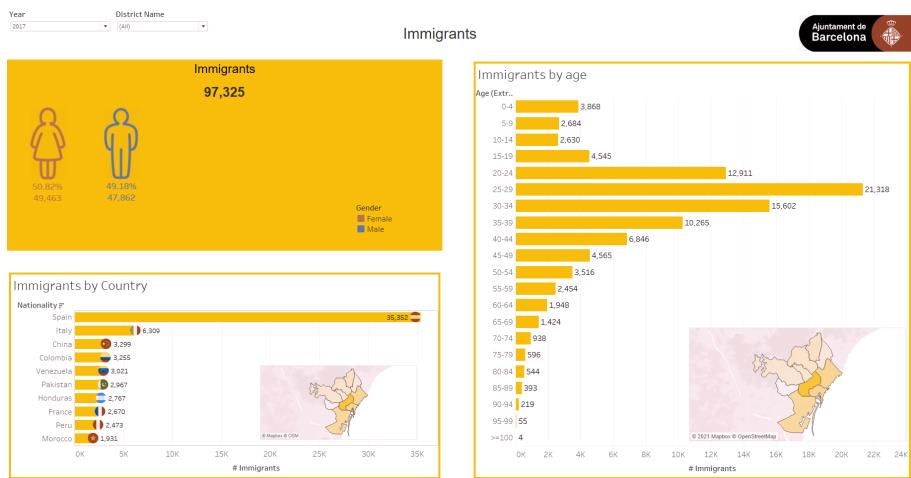


Year
2017 ▾ District Name
(All) ▾ Gender
(All) ▾

Unemployment

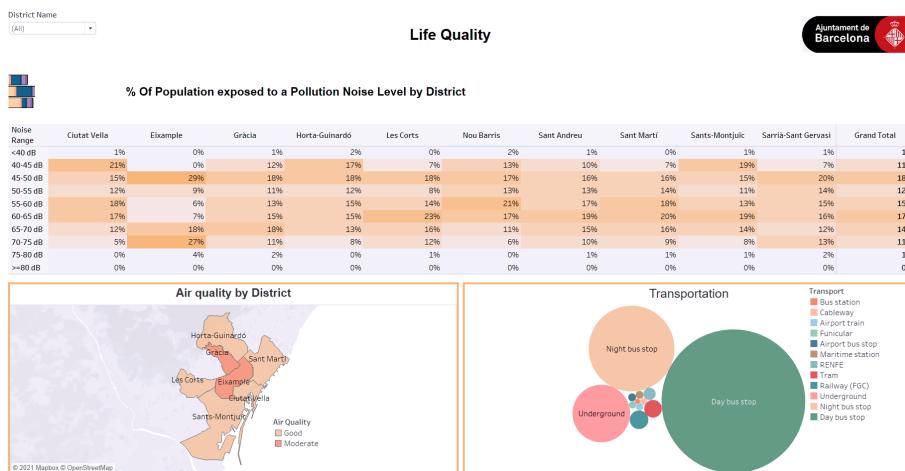
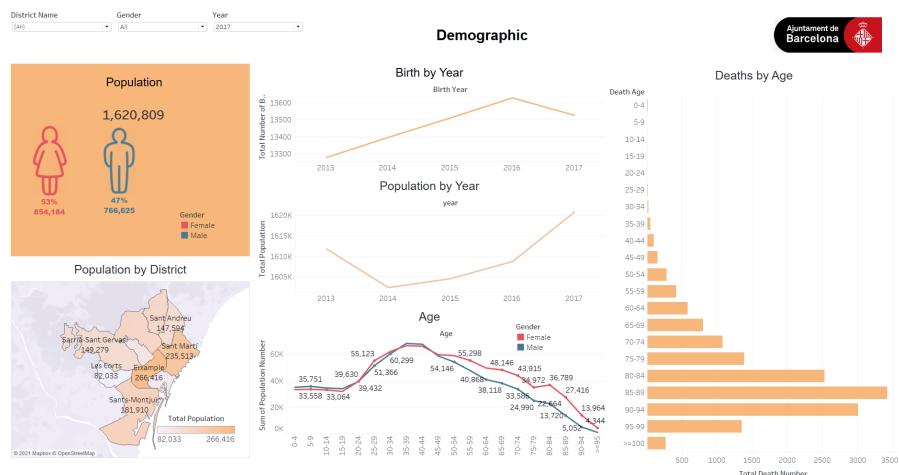
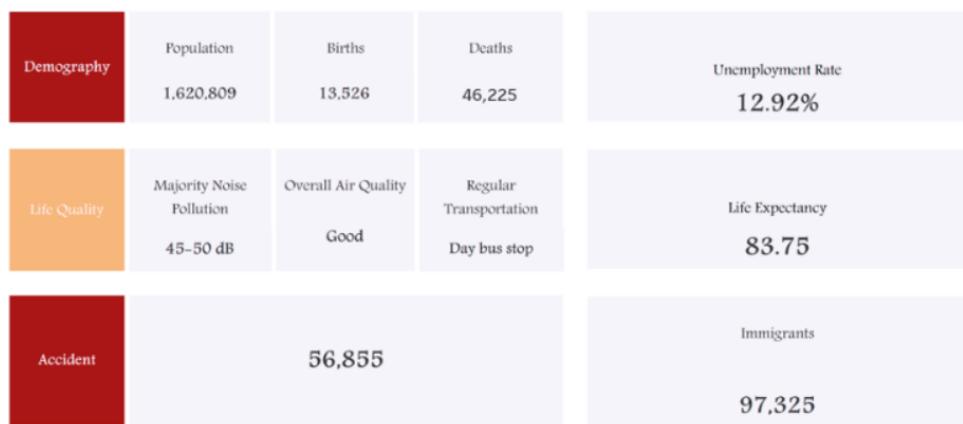
Ajuntament de Barcelona





7.3 Tritanomaly- Blue weak

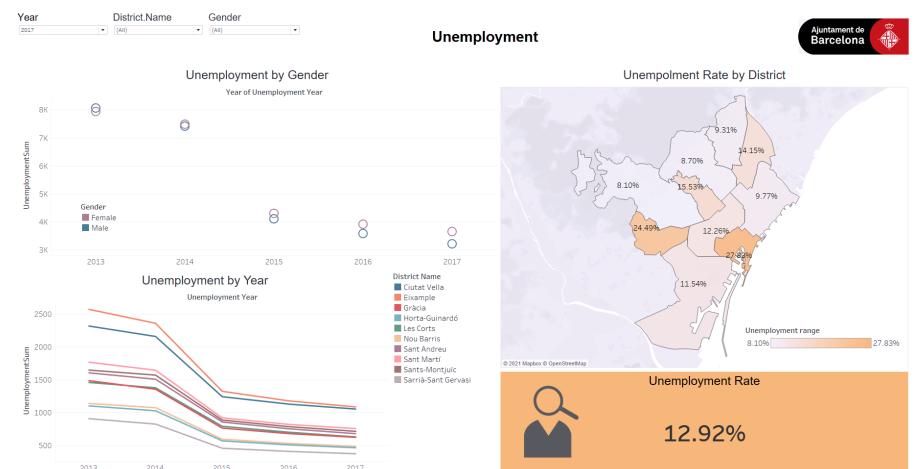
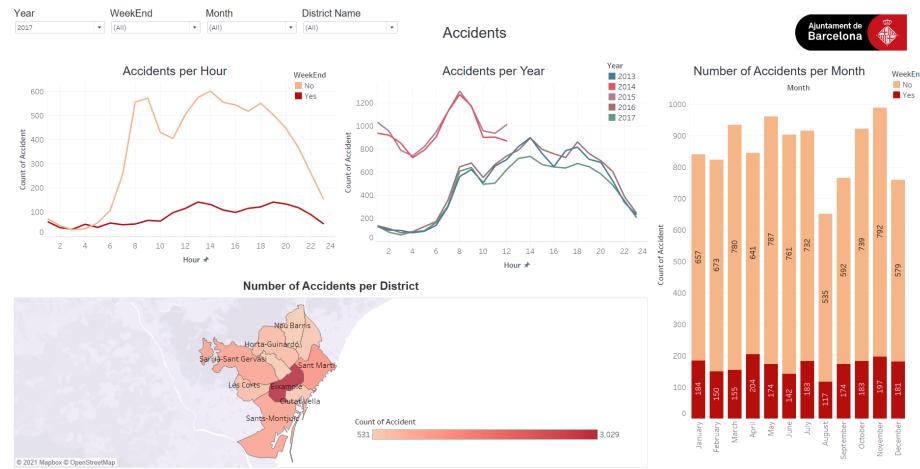
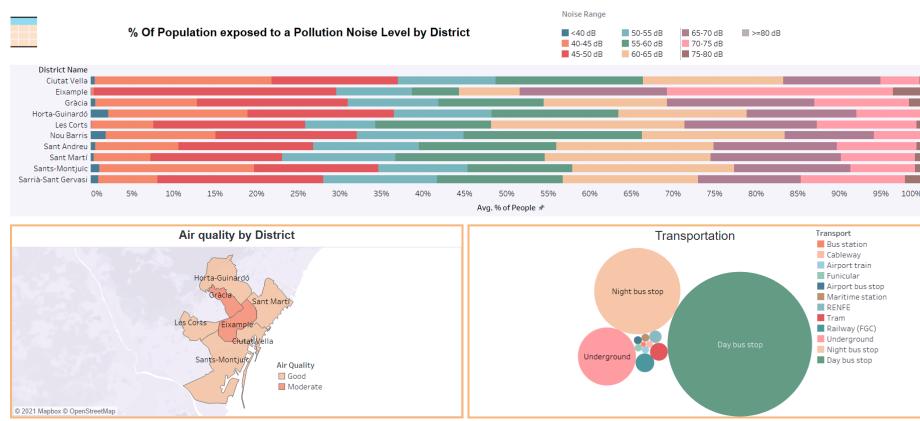
Overview



District Name
(All) ▾

Life Quality

Ajuntament de Barcelona 

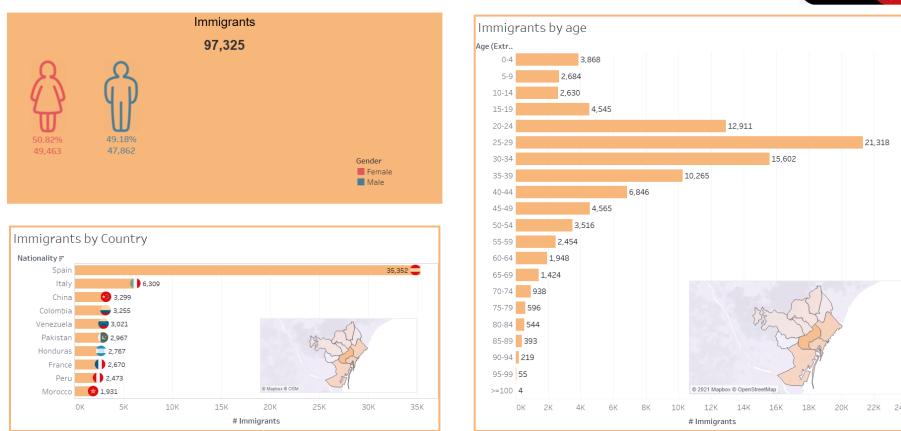


Year District Name

2017 (All)

Immigrants

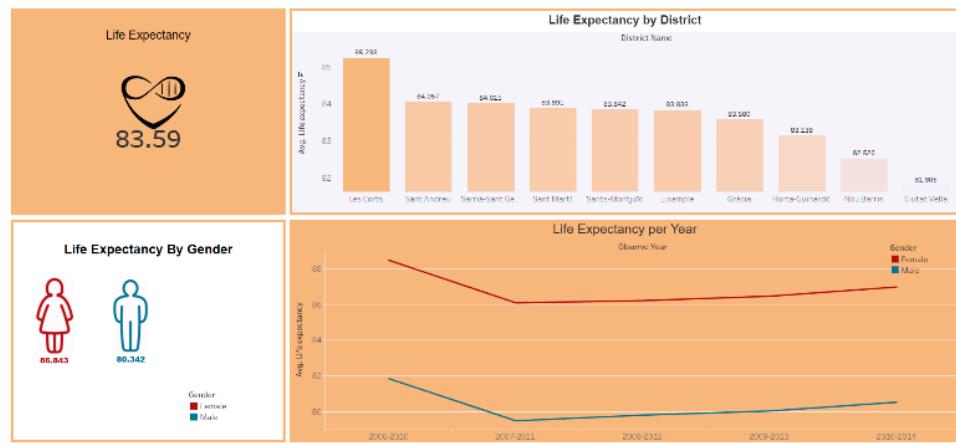
Ajuntament de Barcelona



Gender Observe Year District Name

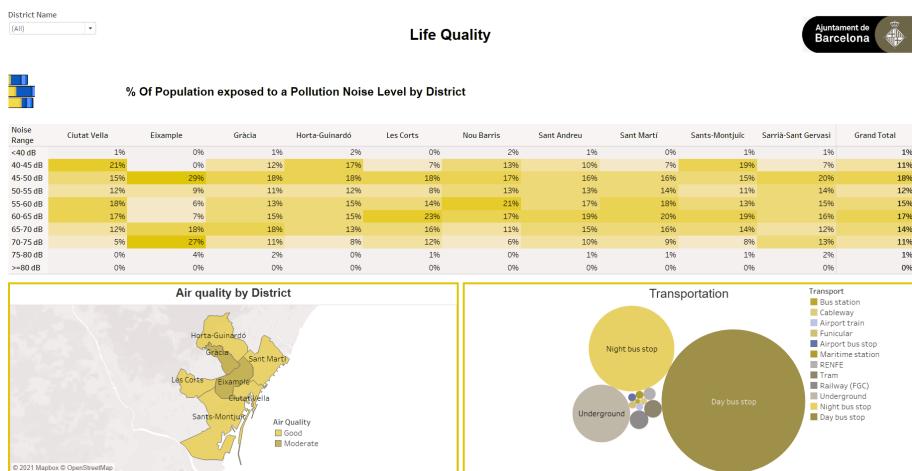
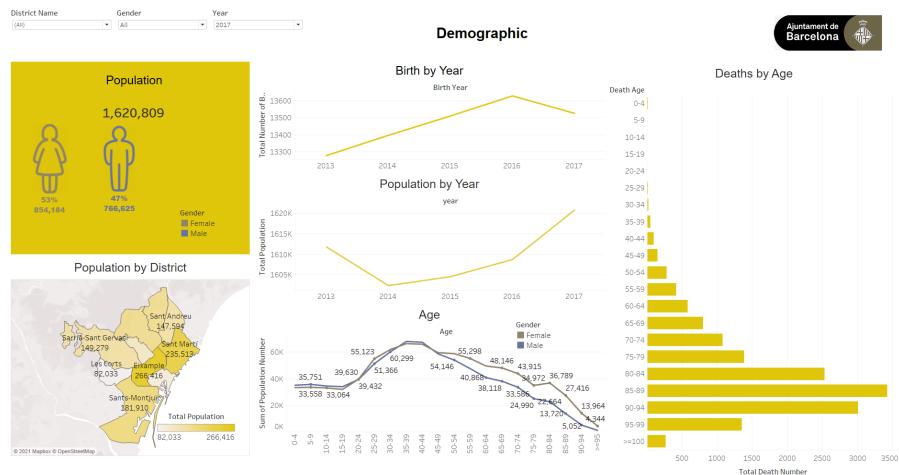
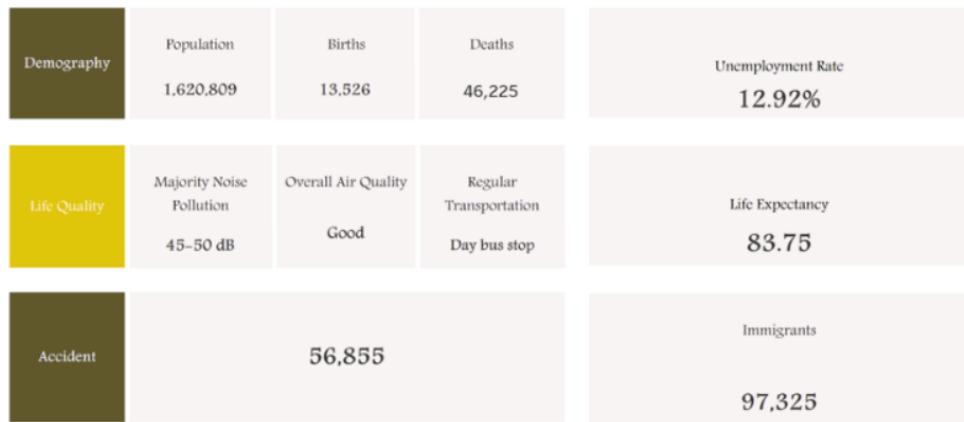
Life Expectancy

Ajuntament de Barcelona



7.4 Protanopia- red blind

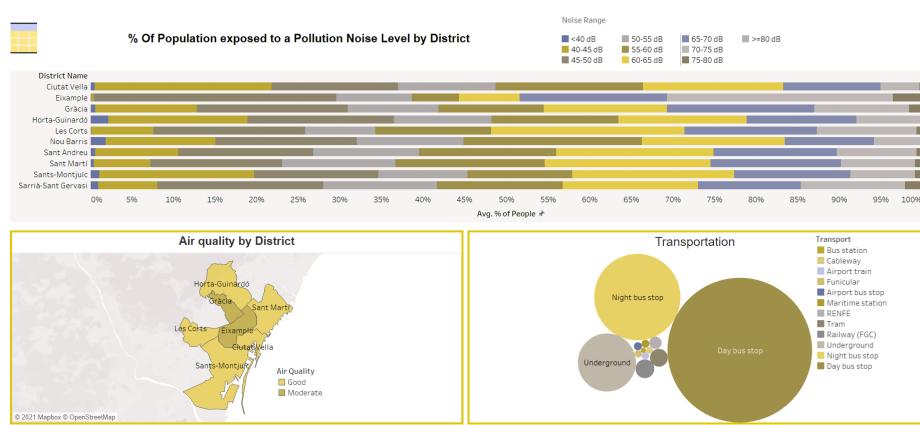
Overview



District Name
(All) ▾

Life Quality

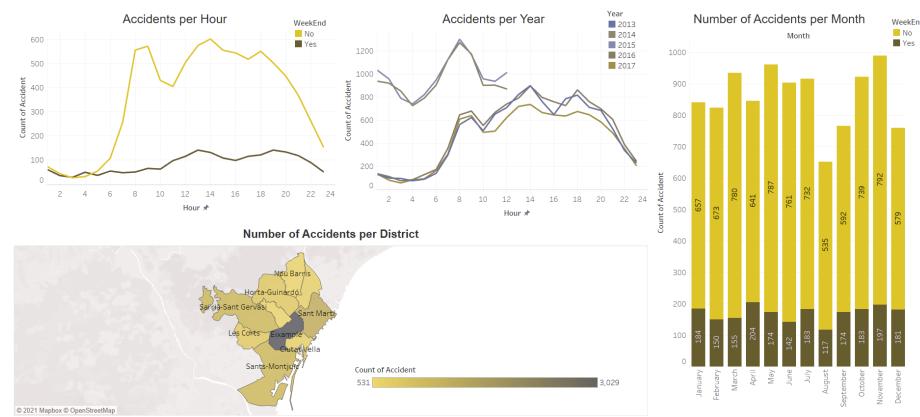
Ajuntament de Barcelona



Year
2017 ▾ WeekEnd
(All) ▾ Month
(All) ▾ District Name
(All) ▾

Accidents

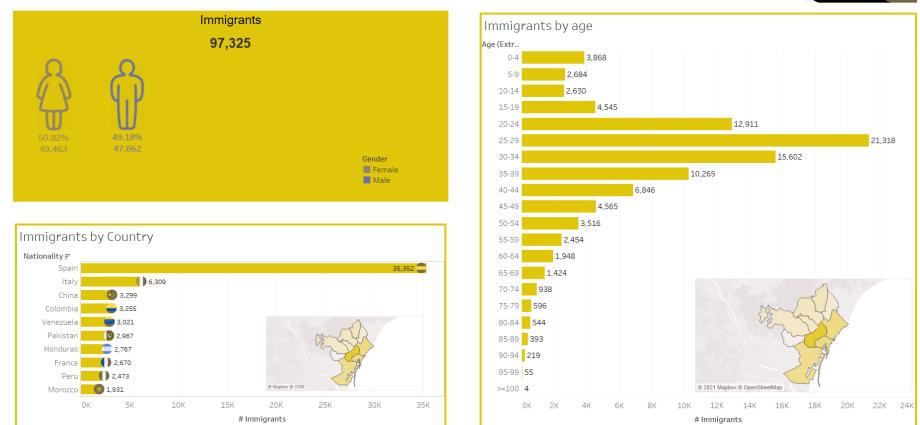
Ajuntament de Barcelona

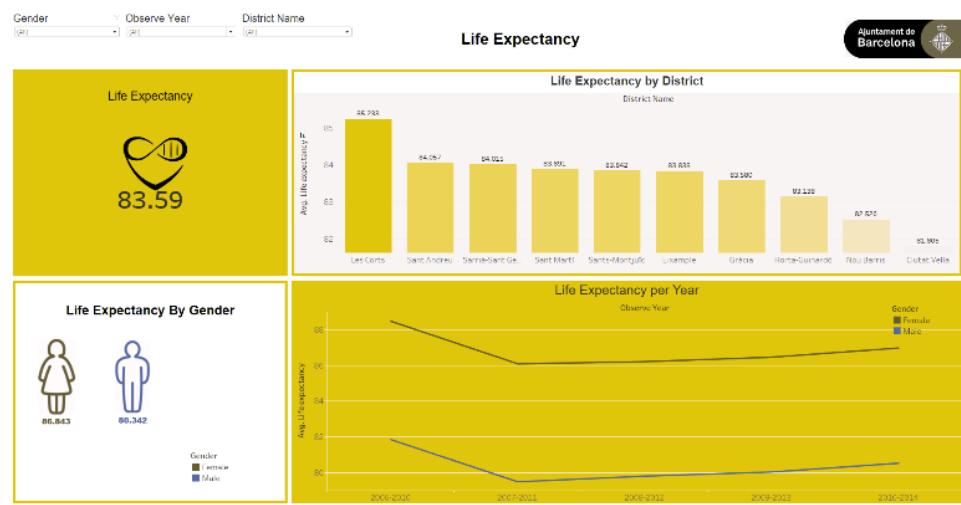
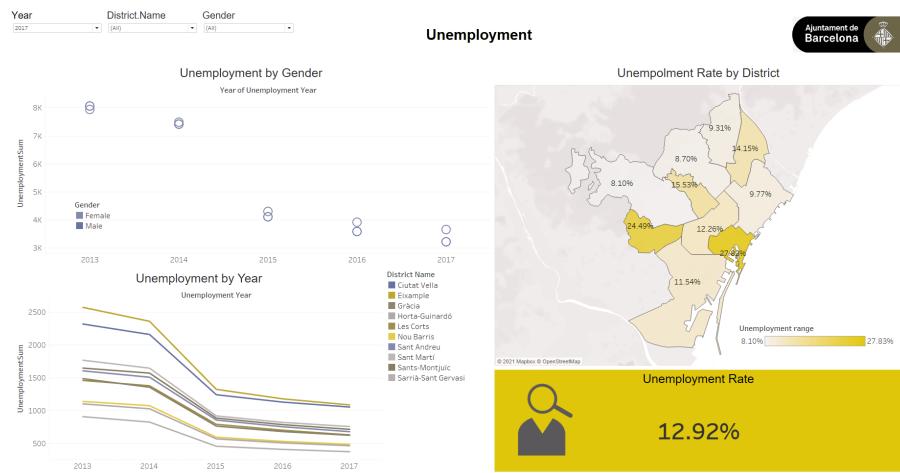


Year
2017 ▾ District Name
(All) ▾

Immigrants

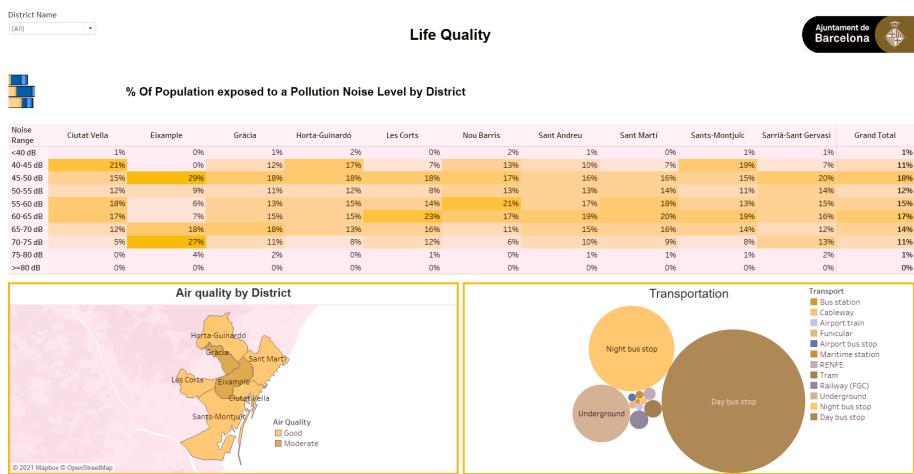
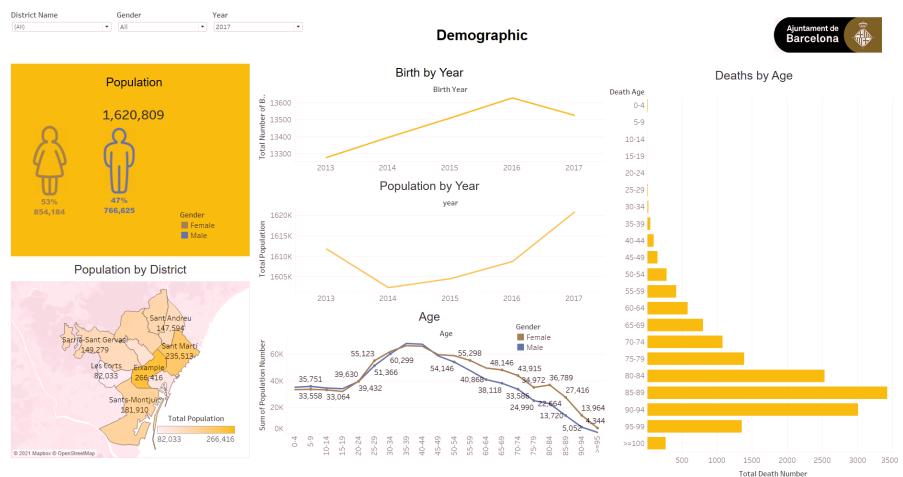
Ajuntament de Barcelona

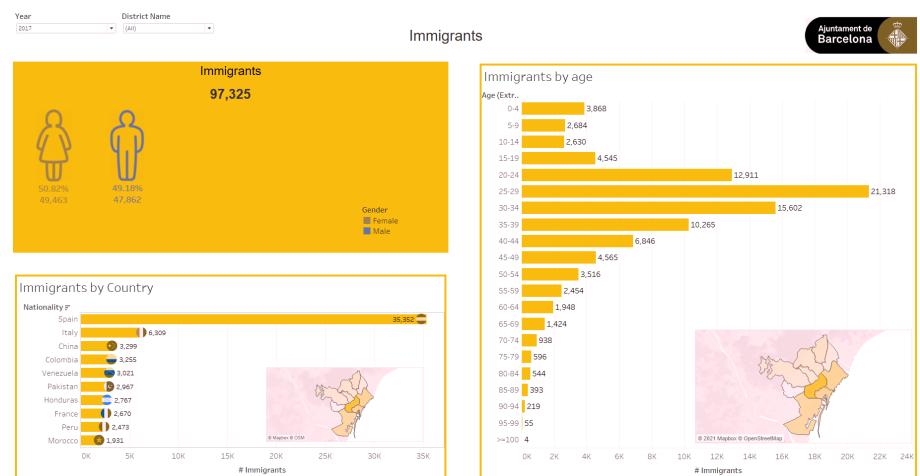
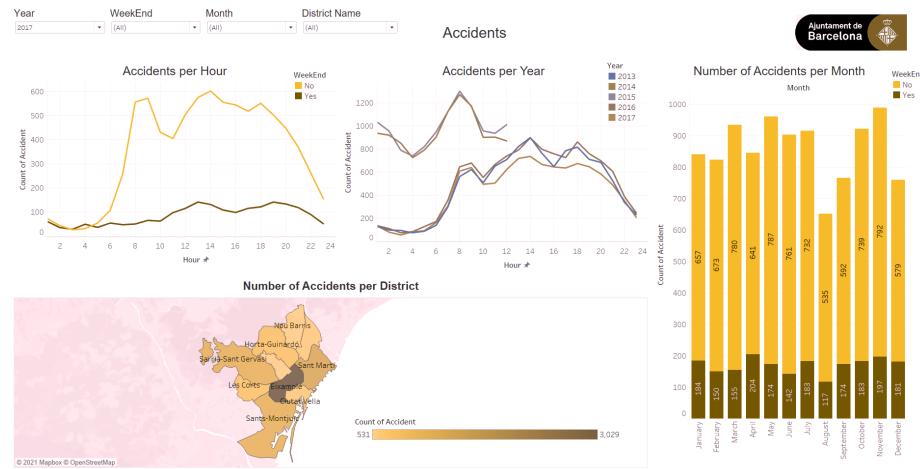
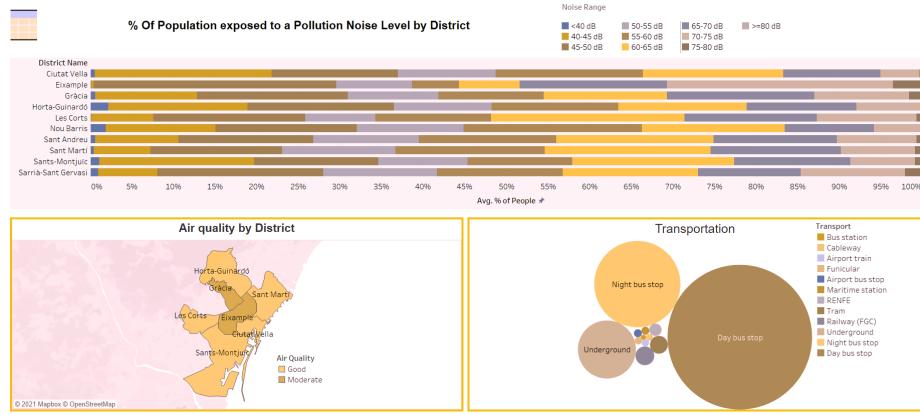


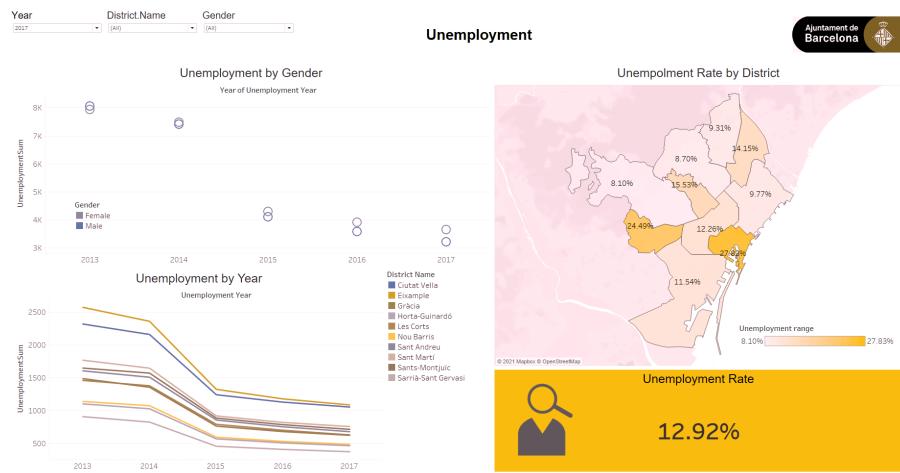


7.5 Deutanopia - Green blind

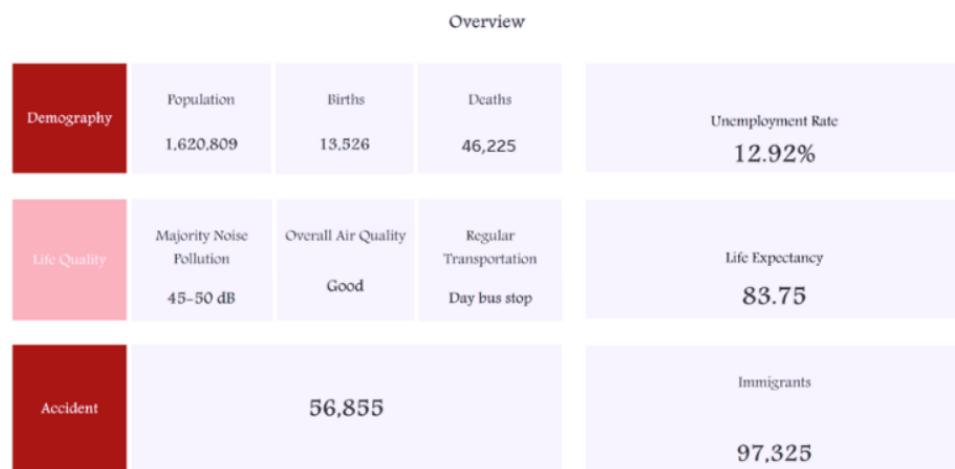
Overview







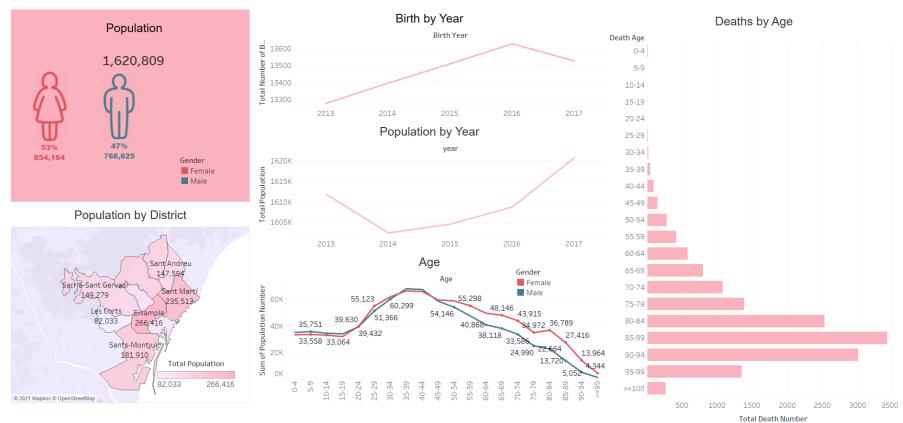
7.6 Tritanopia - blue blind



District Name Gender Year

Demographic

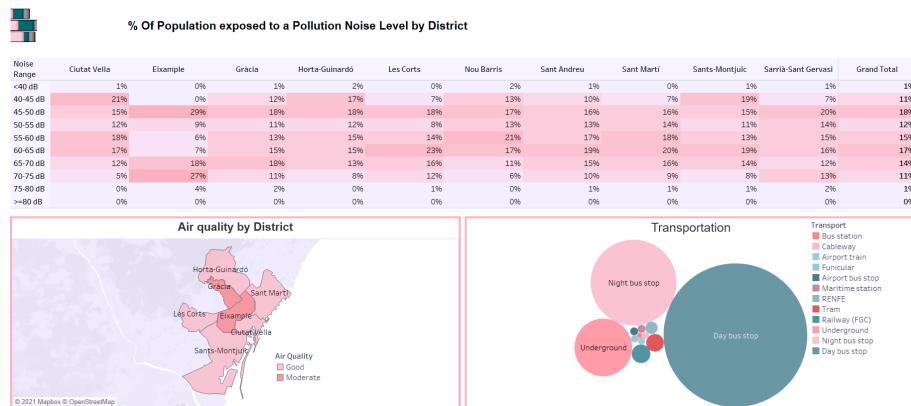
Ajuntament de Barcelona



District Name

Life Quality

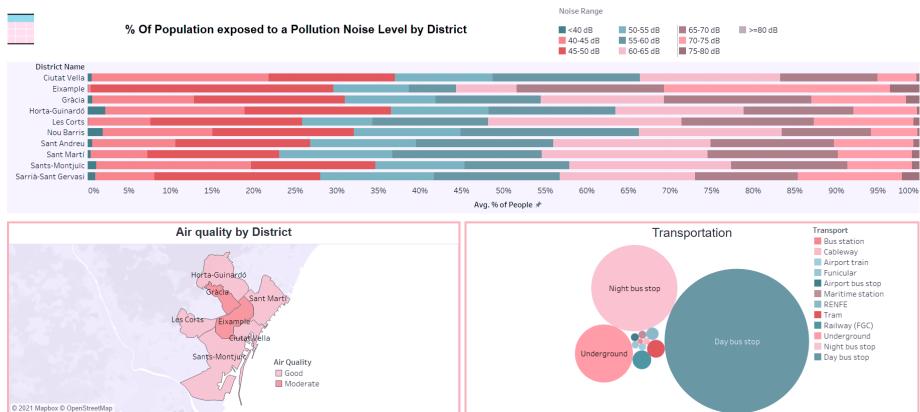
Ajuntament de Barcelona

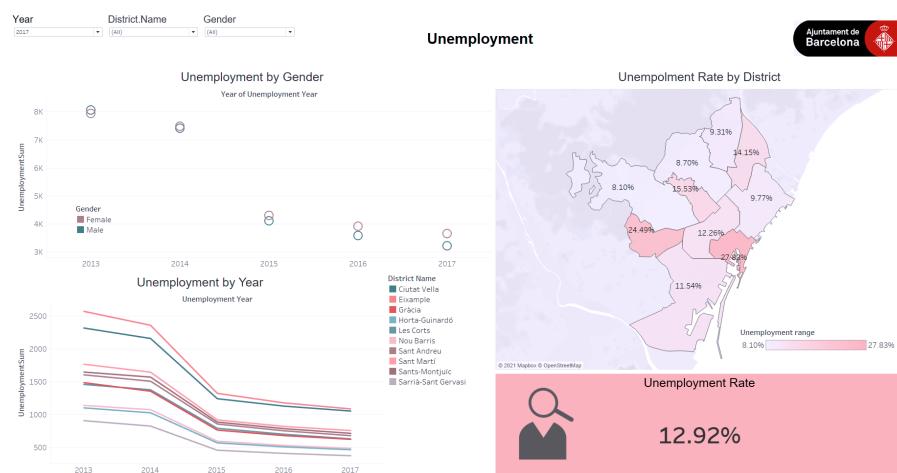
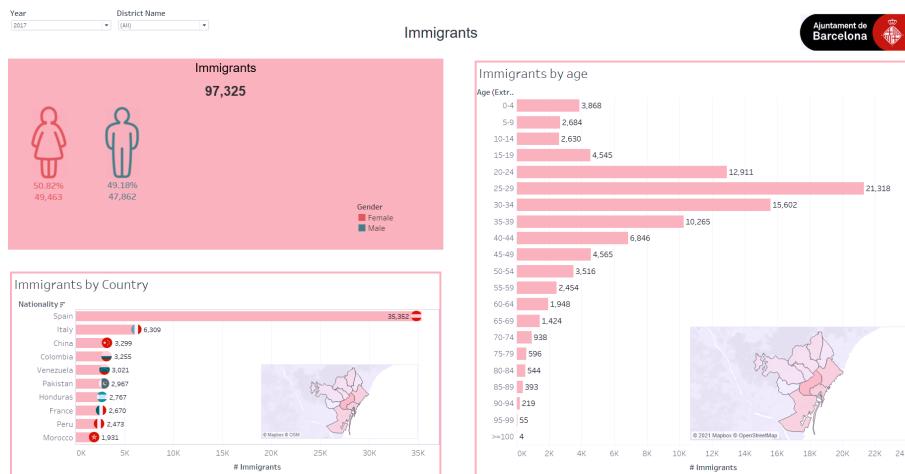
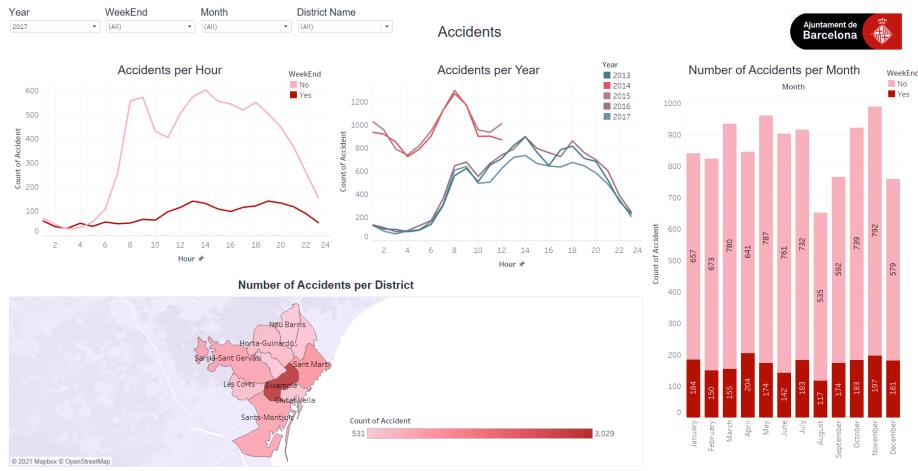


District Name

Life Quality

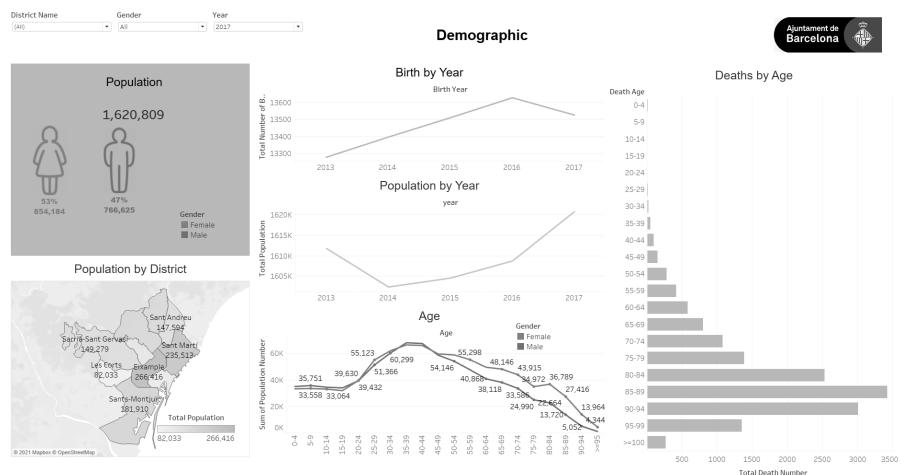
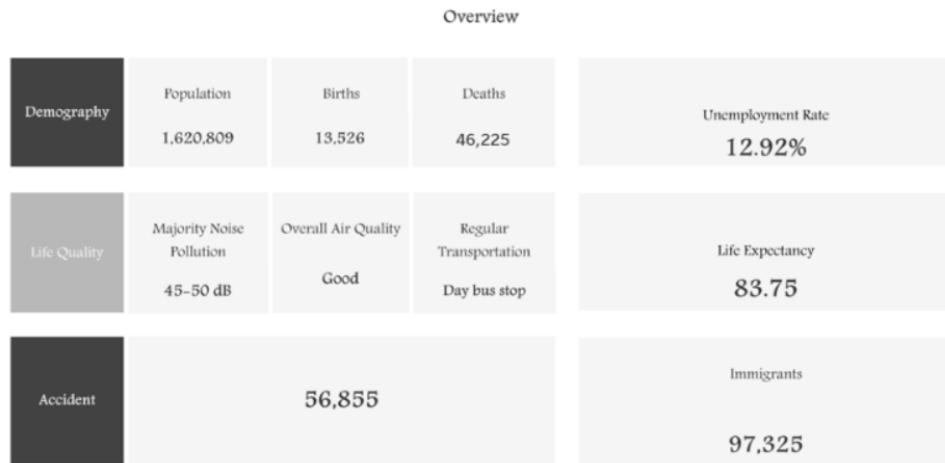
Ajuntament de Barcelona







7.7 Monochromacy - Achromatopsia



District Name
(All) ▾

Life Quality



% Of Population exposed to a Pollution Noise Level by District

Noise Range	Clot del Vell	Exemple	Gràcia	Horta-Guinardó	Les Corts	Nou Barris	Sant Andreu	Sant Martí	Sants-Montjuïc	Sarrià-Sant Gervasi	Grand Total
<40 dB	1%	0%	1%	2%	0%	2%	1%	0%	1%	1%	1%
40-45 dB	21%	0%	12%	17%	7%	13%	10%	7%	19%	7%	11%
45-50 dB	15%	29%	18%	18%	18%	17%	16%	16%	15%	20%	18%
50-55 dB	5%	1%	11%	12%	8%	13%	13%	14%	11%	14%	12%
55-60 dB	18%	6%	13%	15%	14%	21%	17%	10%	13%	15%	15%
60-65 dB	17%	7%	15%	15%	23%	17%	19%	20%	19%	16%	17%
65-70 dB	12%	18%	18%	13%	16%	11%	15%	16%	14%	12%	14%
70-75 dB	5%	27%	11%	8%	12%	6%	10%	9%	8%	13%	11%
75-80 dB	0%	4%	2%	0%	1%	0%	1%	1%	2%	1%	1%
>=80 dB	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Air quality by District



Transportation

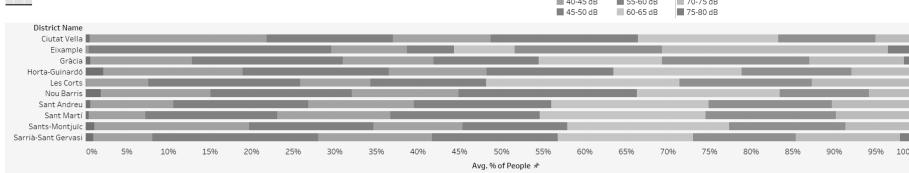


District Name
(All) ▾

Life Quality



% Of Population exposed to a Pollution Noise Level by District



Air quality by District



Transportation

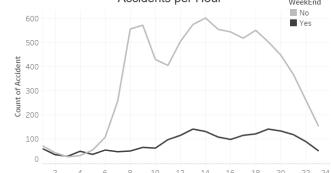


Year
2017 ▾ WeekEnd
(All) ▾ Month
(All) ▾ District Name
(All) ▾

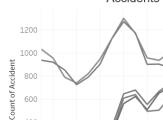
Accidents



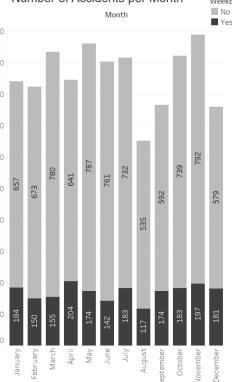
Accidents per Hour



Accidents per Year



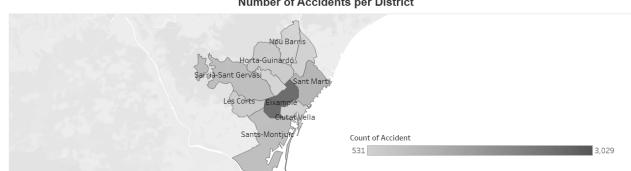
Number of Accidents per Month

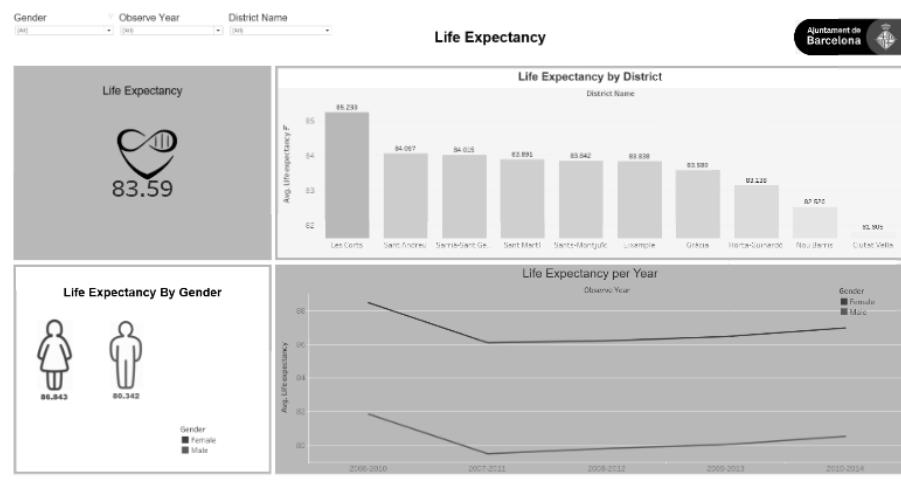
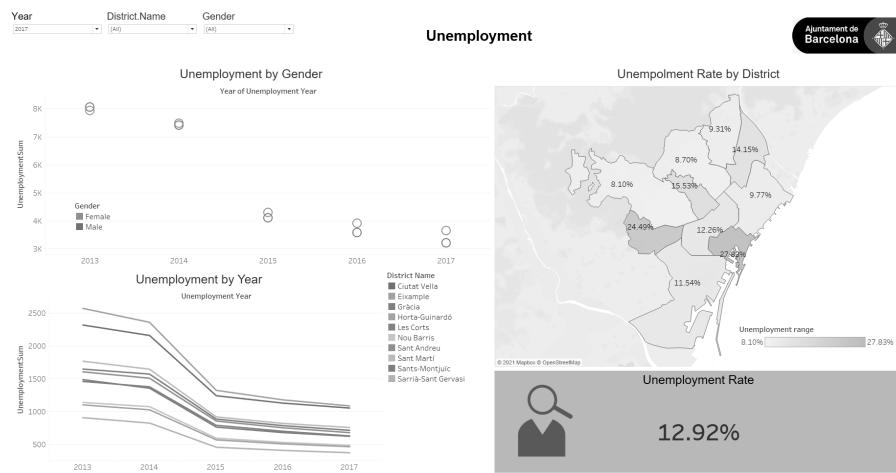
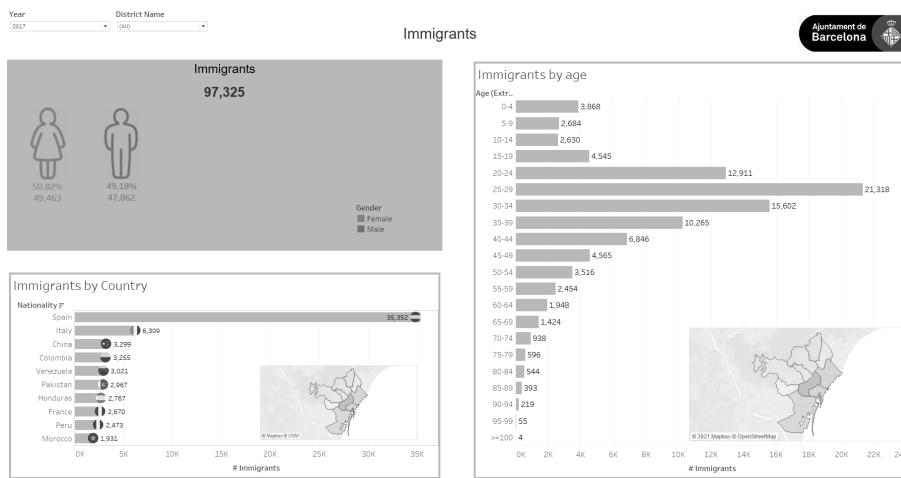


Count of Accident
531 3,029

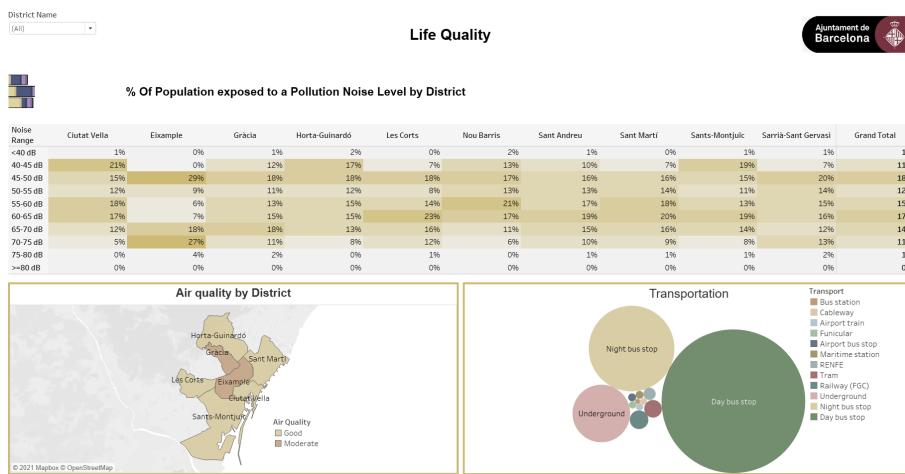
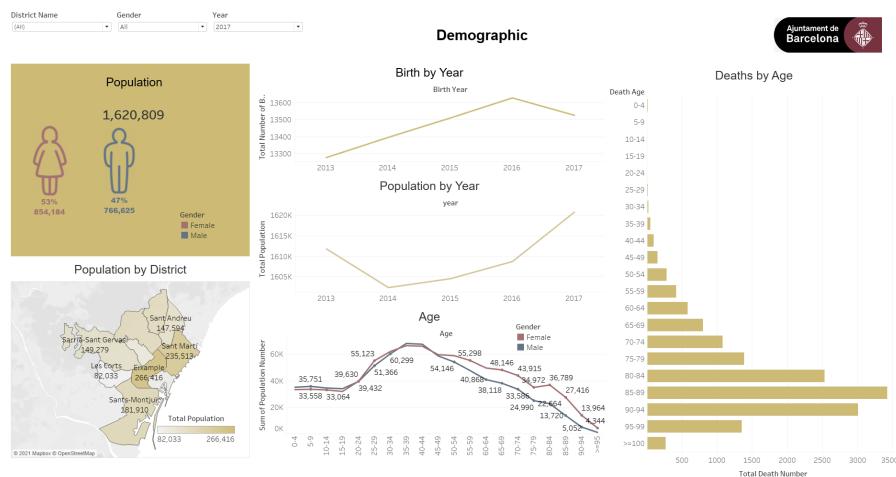
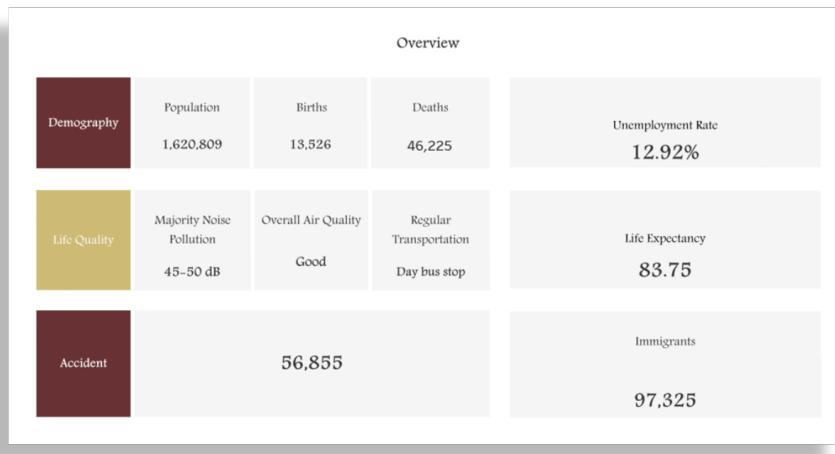
© 2021 Mapbox © OpenStreetMap

Number of Accidents per District





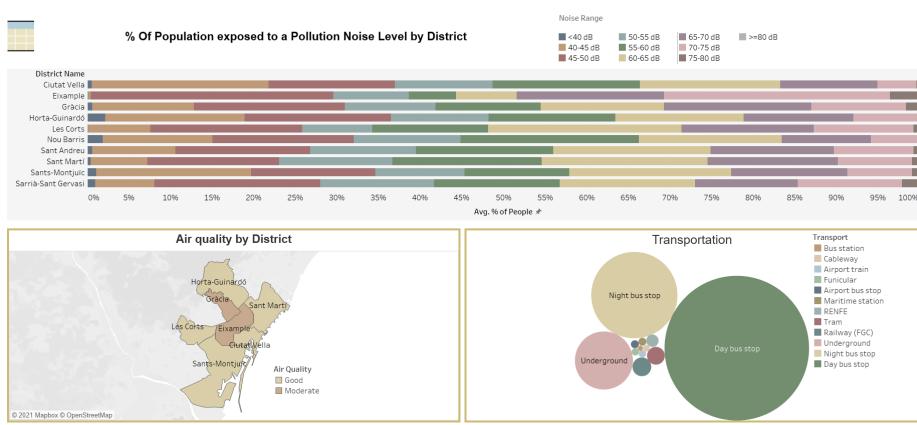
7.8 Monochromacy- Blue Cone



District Name
(All) ▾

Life Quality

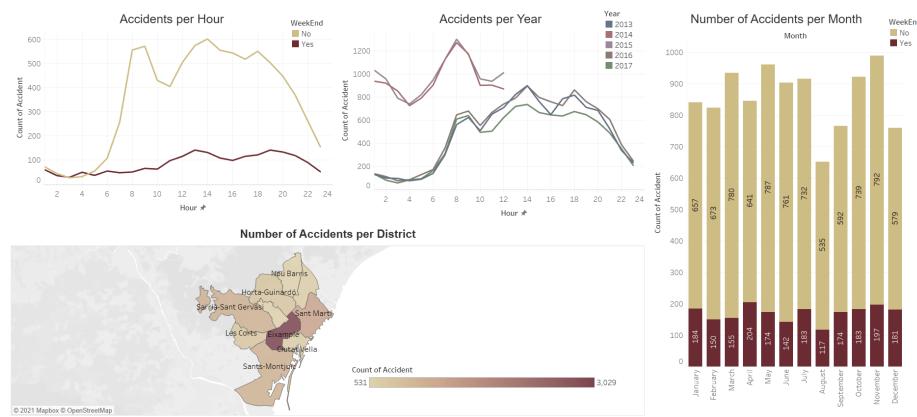
Ajuntament de Barcelona



Year
2017 ▾ WeekEnd
(All) ▾ Month
(All) ▾ District Name
(All) ▾

Accidents

Ajuntament de Barcelona



Year
2017 ▾ District Name
(All) ▾ Gender
(All) ▾

Unemployment

Ajuntament de Barcelona

