

Analysis of the comorbidities associated with the COVID-19 pandemic in Mexico and hospital availability in CDMX

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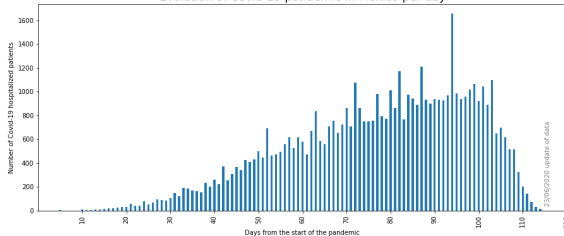
July 14, 2020

Description of the problem

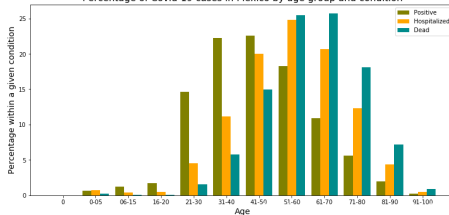
- The COVID-19 pandemic, caused by SARS-CoV-2 virus, has affected the lives of many people around the world.
- At this moment, the pandemic in Mexico is in a critical expansion phase and the evolution of the pandemic in the weeks to come is uncertain.
- We propose to analyze two important aspects of the COVID-19 pandemic in Mexico:
 - The analysis of the main comorbidities associated to COVID-19 in all the country
 - An analysis of the hospital infrastructure available in Mexico City (CDMX) in comparison with the coronavirus cases in each municipality.
- This analysis may be useful for governments and citizens to take preventive policies to reduce the risk of health complications among vulnerable populations.

The COVID-19 pandemic in Mexico

Evolution of Covid-19 pandemic in Mexico per day



Percentage of Covid-19 cases in Mexico by age group and condition



Description and cleaning of data

Analysis of the prevalence of comorbidities for COVID-19 by state:

- Dataset '*casos-asociados-a-covid-19.csv*' at '<https://www.gob.mx/salud/documentos>' and updated on June 23, 2020. Reduced from 384,283 records and 40 fields to 171,371 records and 15 fields.
- Geographical coordinates of the states in Mexico from 'geocoder'.

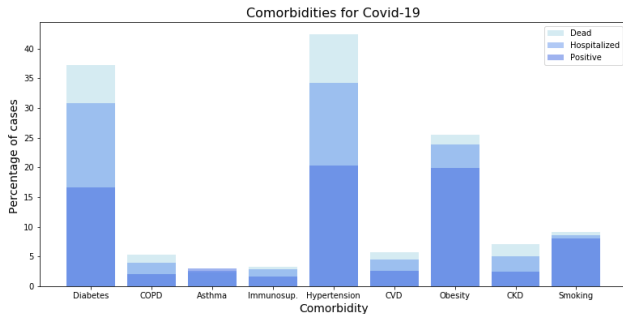
Analysis of the hospital availability in Mexico City:

- Dataset from '<https://datos.cdmx.gob.mx/>' and updated on July 1, 2020. Reduced from 155,722 to 48,565 records.
- Demographic data table from https://en.wikipedia.org/wiki/Municipalities_of_Mexico_City.
- Foursquare search on "*hospital*" venue category in Mexico City.

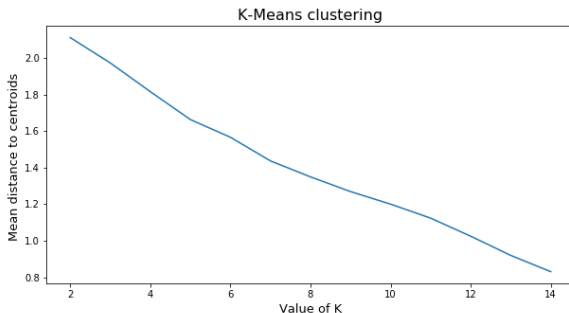
Analysis of the prevalence of comorbidities for COVID-19 by state

Exploratory data analysis: Finding the most relevant comorbidities to be used in the analysis.

	Positive	Hospitalized	Dead
Diabetes	16.69	30.84	37.22
COPD	1.98	3.90	5.36
Asthma	2.96	2.59	2.33
Immunosup.	1.62	2.86	3.27
Hypertension	20.34	34.23	42.34
CVD	2.58	4.51	5.76
Obesity	19.92	23.83	25.45
CKD	2.39	5.06	7.04
Smoking	8.11	8.57	9.10

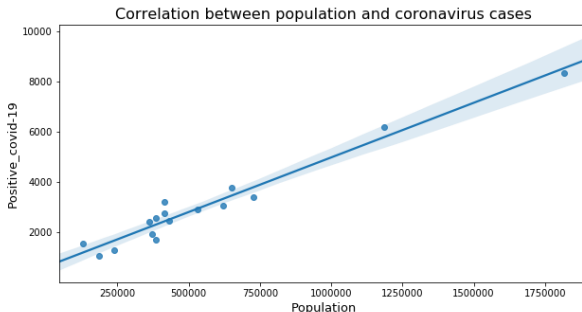


K-means clustering: Determining an adequate value of k to group the 32 Mexican states according to the prevalence of the different comorbidities:

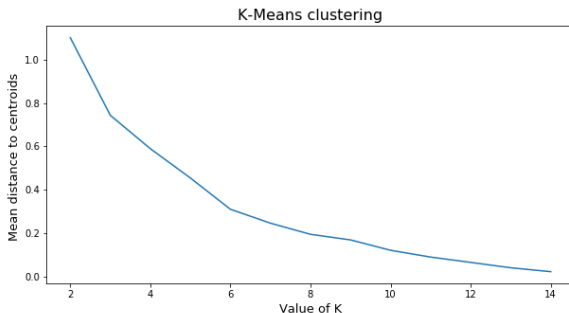


Analysis of the hospital availability in Mexico City

Exploratory data analysis: Establishing correlation between the fields to be used in the analysis.



K-means clustering: Determining the value of k to group the 16 municipalities in CDMX according to population and number of coronavirus cases:



Comorbidities of COVID-19 by state in Mexico



Cluster 1: Baja California, Campeche, Coahuila, Chiapas, Chihuahua, Querétaro, Quintana Roo, Sinaloa, Sonora, Tabasco, Tamaulipas, Veracruz and Yucatán. *Description:* High prevalence of hypertension and relatively low prevalence of COPD.

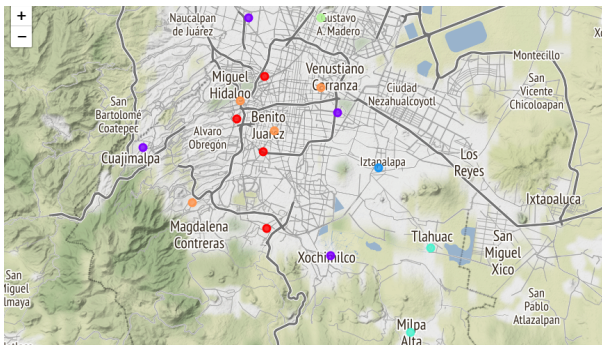
Cluster 2: Ciudad de México, Colima, Estado de México, Guerrero, Hidalgo, Michoacán, Morelos, Oaxaca, Puebla and Tlaxcala. *Description:* Low prevalence of hypertension and relatively low prevalence of CVD and CKD.

Cluster 3: Durango, Guanajuato, Jalisco, Nuevo León and San Luis Potosí. *Description:* High prevalence of diabetes and hypertension and relatively high prevalence of COPD.

Cluster 4: Baja California Sur, Nayarit and Zacatecas. *Description:* High prevalence of immunosuppression and hypertension and relatively high prevalence of COPD, CVD and obesity.

Cluster 5: Aguascalientes. *Description:* Extremely high prevalence of CKD and relatively high prevalence of immunosuppression and CVD. This cluster contains an outlier in data.

Hospital availability by municipality in CDMX



Cluster 1: Benito Juárez, Magdalena Contreras, Miguel Hidalgo and Venustiano Carranza.

Cluster 2: Álvaro Obregón, Coyoacán, Cuauhtémoc and Tlalpan.

Cluster 3: Azcapotzalco, Cuajimalpa, Iztacalco and Xochimilco.

Cluster 4: Gustavo A. Madero.

Cluster 5: Iztapalapa.

Cluster 6: Milpa Alta and Tláhuac.

- Smoking and asthma do not increase considerably the risk of health complications among coronavirus patients in Mexico.
- The main comorbidities for COVID-19 among Mexican population are hypertension, diabetes and obesity.
- The obtained clusters keep relation with geographical proximity of the states.
- There is a strong correlation between the total population and the coronavirus pandemic spread in each municipality in CDMX.
- To improve the analysis additional data is required.