Covid in Ecuador

Applied Data Science Capstone by IBM/Coursera

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Table of contents

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1. Introduction

The first human cases of COVID-19 were identified in Wuhan, Hubei, China, in December 2019. As a result of COVID-19 many regions have imposed lockdowns, curfews and quarantines alongside new legislation and evacuations, or other restrictions for citizens of or recent travelers to the most affected areas.[1] Other regions have imposed global restrictions that apply to all foreign countries and territories, or prevent their own citizens from travelling overseas.[2]

The pandemic was confirmed to have reached South America on 26 February 2020 when Brazil confirmed a case in São Paulo. [3] By 3 April, all countries and territories in South America had recorded at least one case. [4]

In Ecuador, the virus was reported to have spread to Ecuador on 29 February 2020 when a woman in her 70s tested positive for the virus. This disease has caused a several disrupt in the economy and life for every citizen in Ecuador. As result, this project is targeted to get more knowledge about this disease. Specifically, finding hot spots and warns people about the situation of each province in Ecuador.

Referenced entries:

1. "Coronavirus Travel Restrictions, Across the Globe". The New York Times. 26 March 2020.
2. "Coronavirus (COVID-19) – information for Australian travelers". Australian Government. Retrieved 4 September 2020.
3. Horwitz L, Nagovitch P, Sonnel HK, Zissis C. "Where Is the Coronavirus in Latin America?". AS/COA. Archived from the original on 22 March 2020. Retrieved 22 March 2020.

4. "Uncollected bodies lie for days in the streets of Ecuador the emerging epicentre of the coronavirus in Latin America". Stuff/Fairfax. 4 April 2020.

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2. Description of the problem

Ecuador has one of the highest per capita Covid-19 deaths rates in the world, according to research from Johns Hopkins University. A New York Times analysis of over two dozen countries found that Ecuador had one of the highest excess death rate [1]. Therefore, as a current resident of Ecuador, I am concerned about my family safety in this country, and I want to know where are located the highest spot of Covid in this country. This information will help helpful to travel within this country and acknowledge Ecuadorians where they Ecuador can stay safely from this brutal disease.

Reference entry:

1. url: Noah Smith, [Covid-19 in Ecuador: An Exclusive Q&A with Ecuador's Ambassador to the U.S.](#)

2.1. Background

- **Country-Specific Information:**

1. Ecuador has confirmed positive cases of COVID-19 in all 24 provinces.
2. On August 6, the U.S. Department of State removed the Global Health Advisory Level 4. Ecuador is now listed as Level 3: Reconsider Travel[1].
3. The COVID-19 pandemic in Ecuador is part of the worldwide pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus was reported to have spread to Ecuador on 29 February 2020 when a woman in her 70s tested positive for the virus. Ecuador was described in April as emerging as a possible "epicentre" of the pandemic in Latin America,[2] with the city of Guayaquil overwhelmed to the point where bodies were being left in the street[3].

Referenced entries:

1. url: CS Unit, 19 October, 2020 url: https://ec.usembassy.gov/covid-19-information-ecu-2/
2. "Uncollected bodies lie for days in the streets of Ecuador the emerging epicentre of the coronavirus in Latin America". Stuff/Fairfax. 4 April 2020.
3. "Ecuador coronavirus: Bodies are being left in the streets in an overwhelmed city". msn.com. Retrieved 5 April 2020.

3. Data:

Based on the definition of the problem, there are several significant variables that are included in this analysis. These variables were extracted from the following sources:

1. The first source that I am using is from Wikipedia. Specifically, it is a page with data about COVID-19 pandemic in Ecuador:

   [* 1.1. COVID-19 pandemic in Ecuador:](#) This link provides us a table that contains the current **number of confirmed cases** and **deaths** by **province** in Ecuador.

2. The second source of data is the geolocation data of each province in Ecuador. This information was extracted using geopy locator and can provide the **latitude** and **longitude** of each province in Ecuador.

3. The Third data is the **nearby venues in Ecuador** that were extracted using the **Foursquare API**. This data will help me to find the relations of Covid hotspots in Ecuador.

4. The fourth data is provided by jpmarindiaz git :[Geojson](#), which provides us with a geojson of Ecuador. This data will help to plot a choroplet map of each province in Ecuador.

4. Methodology

There are several methodology implemented within this project. The following include:

- Web scrapping.
- Organization and collection of data.
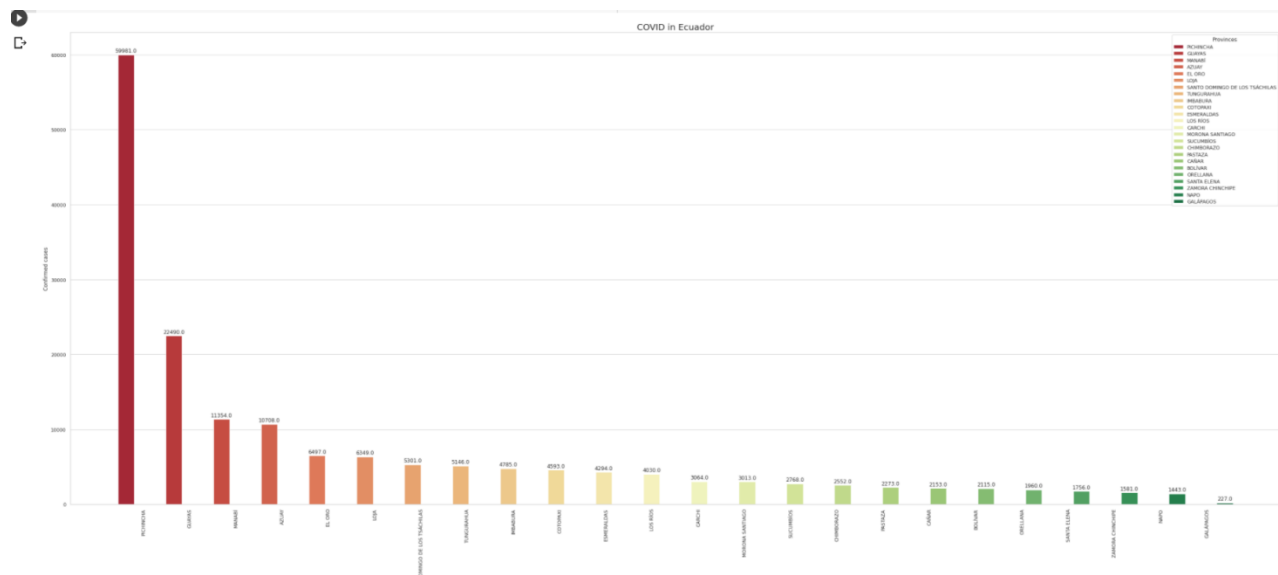- Geolocation of ach province and nearby venues.
- Plotting with folium.

5. Results

Applying web scrapping and beautiful soup, the following data is extracted from the Wikipedia page.
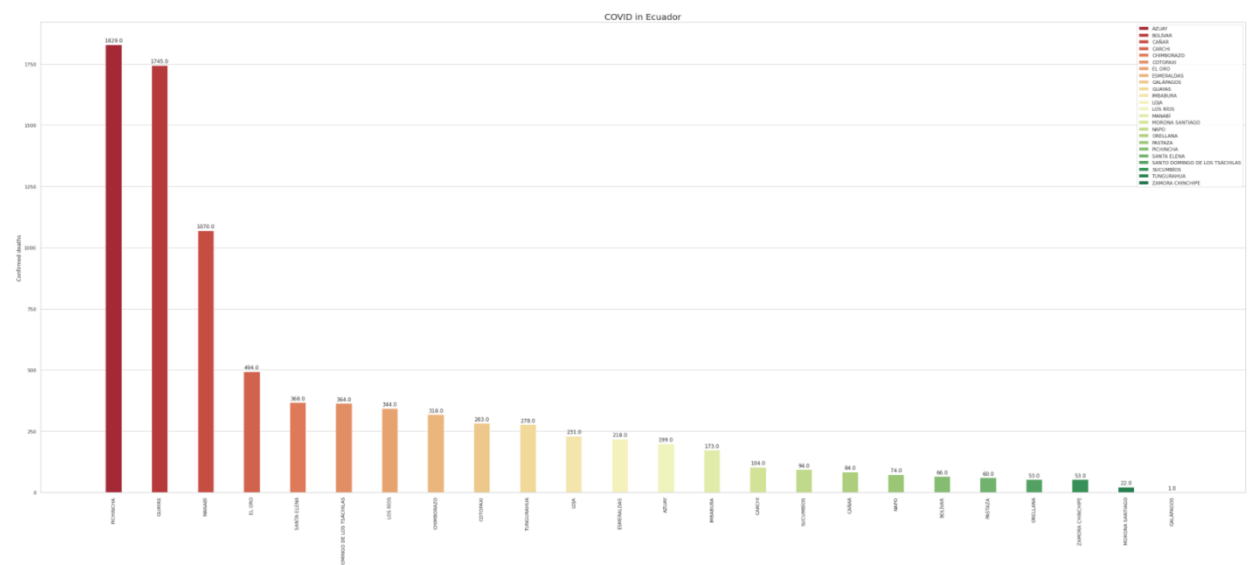
Table 1. Ecuador Covid Dataframe

	Provinces	Confirmed cases	Confirmed deaths	Probable deaths
0	AZUAY	10900.0	199.0	12.0
1	BOLÍVAR	2147.0	66.0	12.0
2	CAÑAR	2184.0	84.0	6.0
3	CARCHI	3123.0	104.0	1.0
4	CHIMBORAZO	2595.0	318.0	120.0
5	COTOPAXI	4671.0	283.0	63.0
6	EL ORO	6605.0	494.0	186.0
7	ESMERALDAS	4429.0	218.0	52.0
8	GALÁPAGOS	230.0	1.0	1.0
9	GUAYAS	22883.0	1745.0	1652.0
10	IMBABURA	4896.0	173.0	7.0
11	LOJA	6501.0	231.0	46.0
12	LOS RÍOS	4099.0	344.0	238.0
13	MANABÍ	11650.0	1070.0	1032.0
14	MORONA SANTIAGO	3071.0	22.0	0.0
15	NAPO	1458.0	74.0	2.0
16	ORELLANA	2007.0	53.0	17.0
17	PASTAZA	2283.0	60.0	15.0
18	PICHINCHA	62195.0	1829.0	246.0
19	SANTA ELENA	1832.0	368.0	274.0
20	SANTO DOMINGO DE LOS TSÁCHILAS	5351.0	364.0	116.0
21	SUCUMBÍOS	2808.0	94.0	2.0
22	TUNGURAHUA	6205.0	278.0	223.0
23	ZAMORA CHINCHIPE	1588.0	53.0	1.0

In this section, the dataframe is used to visualize several results that are important for the analysis.

Figure 1. Confirmed cases of Covid in Ecuador

There were 62195 cases in Pinchicha and 22883 in Guayas. Indeed, these two provinces together concentrated 48.41 % of the total cases in Ecuador.

Figure 2. Confirmed deaths of Covid in Ecuador.

Besides, Pichincha has 1892 deaths and Guayas has 1745 deaths confirmed by Covid. As a consequence, Pichincha and Guayas have 42.7% percent of the confirmed deaths for Covid in Ecuador.

To get more information, using the API Foursquare, the location (latitude, longitude) of these provinces were extracted:
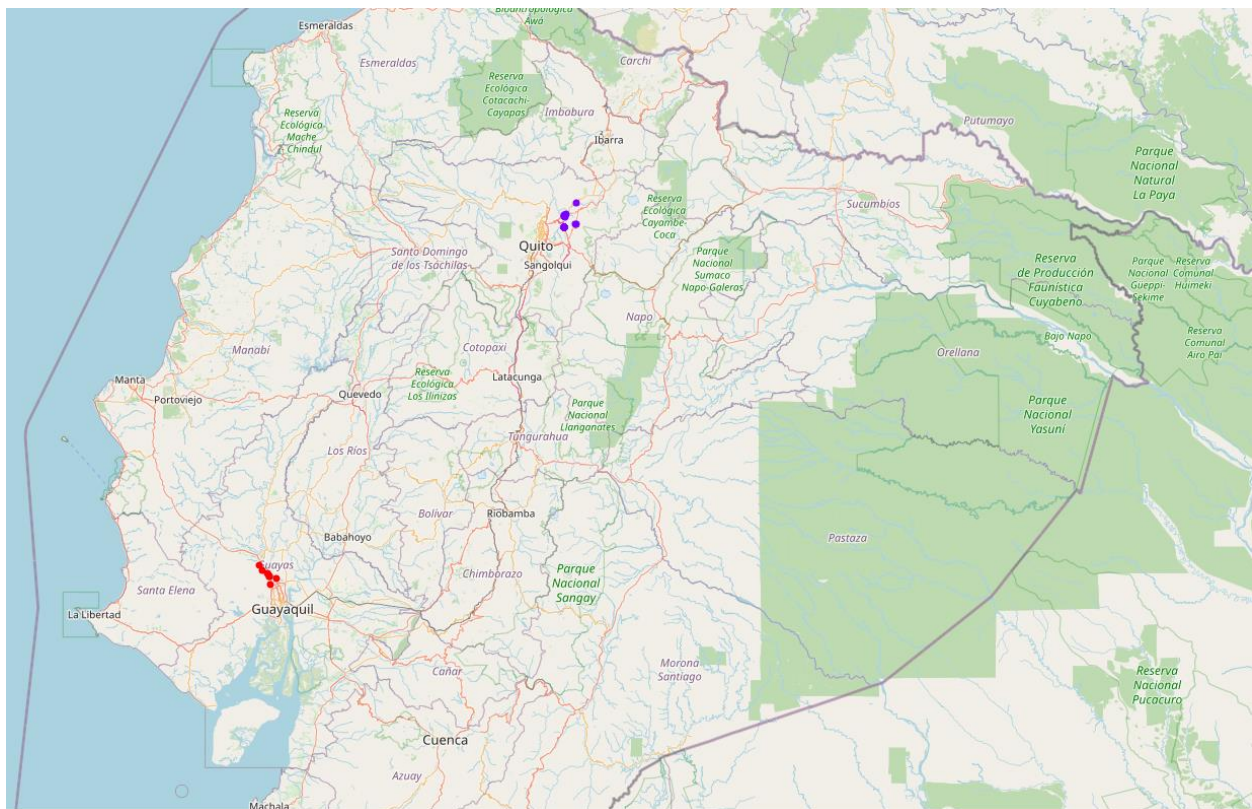
Guayas:

- Guayas latitude: -2.0
- Guayas longitude: -80.0

Pichincha:

- Pichincha latitude: -0.0584893
- Pichincha longitude: -78.3284371

Additionally, the top 29 common venues in Guayas and Pichincha were also obtained. In these results, we notice that the most common venue in Guayaquil was the Country Club, which is a Golf Course,and, in Pichincha the first most common venue was the Airport which is the "Aeropuerto Internacional Mariscal Sucre (UIO)".

Figure 3. Cluster of venues

Figure 4. Choropleth map of confirmed cases

The previous choroplet map and the cluster map confirm that Pinchichas and Guayas are the most affected provinces with Covid-19.

6.Discussions and Observation

The COVID-19 pandemic in Ecuador is part of the worldwide pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus was reported to have spread to Ecuador on 29 February 2020, according to the [National Bulletin](https://www.salud.gob.ec/wp-content/uploads/2020/09/Boletin-182_Nacional_MSP.pdf) published by the government in 29/08/2020 at 8:00 a.m .

The most affected provinces were Pinchicha and Guayas, as it is shown in figures 1 and 2, which plot how many confirmed and death cases were in all the 23 provinces. Besides, Pichincha has 1892 deaths and Guayas has 1745 deaths confirmed by Covid. As a consequence, Pichincha and Guayas has 42.7% percent of the confirmed deaths for Covid in Ecuador.

To get more information, using the API Foursquare, the location (latitude, longitude) of these provinces were extracted:

Guayas:

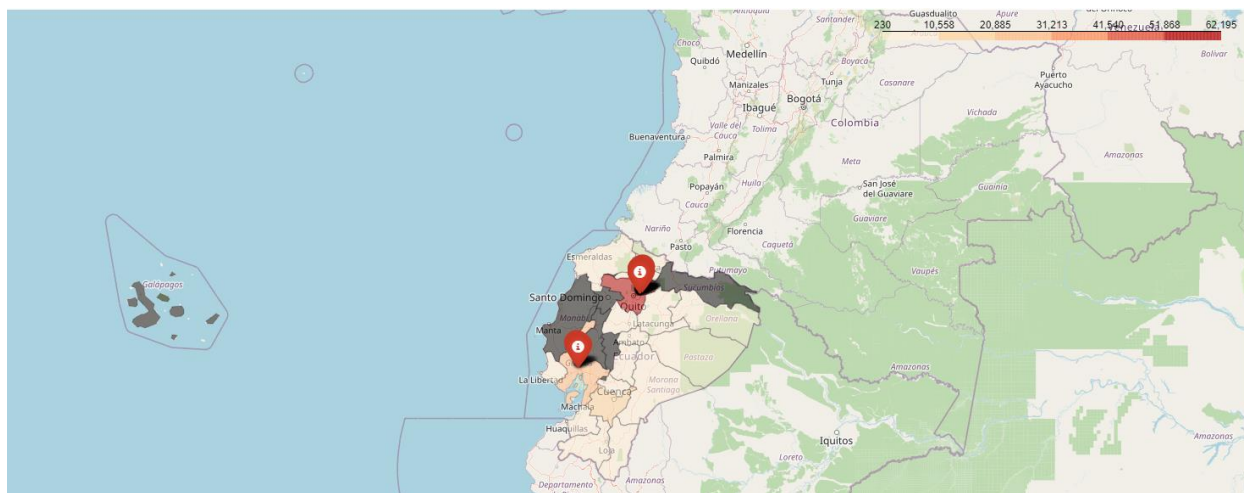- Guayas latitude: -2.0
- Guayas longitude: -80.0

Pichincha:

- Pichincha latitude: -0.0584893
- Pichincha longitude: -78.3284371

Additionally, the top 29 common venues in Guayas and Pichincha were also obtained. In these results, we notice that the most common venue in Guayaquil was the Country Club, which is a Golf Course, and, in Pichincha the first most common venue was the Airport which is the "Aeropuerto Internacional Mariscal Sucre (UIO)".

	Latitude	Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category	Confirmed cases	Confirmed deaths	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue	11th Most Common Venue	12th Most Common Venue	13th Most Common Venue	14th Most Common Venue	15th Most Common Venue
0	-2.0	-80.0	Guayaquil Country Club	-2.016583	-79.960195	Golf Course	22883.0	1745.0	0	Golf Course	Zoo	Restaurant	Big Box Store	Breakfast Spot	Factory	Department Store	Café	Airport Lounge	Airport Service	Airport Terminal	American Restaurant	Argentinian Restaurant	Bakery	Bed & Breakfast
1	-2.0	-80.0	Paradero Manabita	-1.980300	-79.998382	Restaurant	22883.0	1745.0	0	Golf Course	Zoo	Restaurant	Big Box Store	Breakfast Spot	Factory	Department Store	Café	Airport Lounge	Airport Service	Airport Terminal	American Restaurant	Argentinian Restaurant	Bakery	Bed & Breakfast
2	-2.0	-80.0	Zoológico El Pantanal	-2.003426	-79.965139	Zoo	22883.0	1745.0	0	Golf Course	Zoo	Restaurant	Big Box Store	Breakfast Spot	Factory	Department Store	Café	Airport Lounge	Airport Service	Airport Terminal	American Restaurant	Argentinian Restaurant	Bakery	Bed & Breakfast
3	-2.0	-80.0	Cervecería Nacional	-2.061062	-79.955264	Factory	22883.0	1745.0	0	Golf Course	Zoo	Restaurant	Big Box Store	Breakfast Spot	Factory	Department Store	Café	Airport Lounge	Airport Service	Airport Terminal	American Restaurant	Argentinian Restaurant	Bakery	Bed & Breakfast
4	-2.0	-80.0	Paradero Chiveria	-1.952585	-80.011775	Breakfast Spot	22883.0	1745.0	0	Golf Course	Zoo	Restaurant	Big Box Store	Breakfast Spot	Factory	Department Store	Café	Airport Lounge	Airport Service	Airport Terminal	American Restaurant	Argentinian Restaurant	Bakery	Bed & Breakfast
5	-2.0	-80.0	Tía Centro Nacional De Distribución	-1.997901	-79.967582	Department Store	22883.0	1745.0	0	Golf Course	Zoo	Restaurant	Big Box Store	Breakfast Spot	Factory	Department Store	Café	Airport Lounge	Airport Service	Airport Terminal	American Restaurant	Argentinian Restaurant	Bakery	Bed & Breakfast
6	-2.0	-80.0	Guayaquil Country Club	-2.015306	-79.961163	Golf Course	22883.0	1745.0	0	Golf Course	Zoo	Restaurant	Big Box Store	Breakfast Spot	Factory	Department Store	Café	Airport Lounge	Airport Service	Airport Terminal	American Restaurant	Argentinian Restaurant	Bakery	Bed & Breakfast
7	-2.0	-80.0	Almacenes Tia	-2.026562	-79.918268	Big Box Store	22883.0	1745.0	0	Golf Course	Zoo	Restaurant	Big Box Store	Breakfast Spot	Factory	Department Store	Café	Airport Lounge	Airport Service	Airport Terminal	American Restaurant	Argentinian Restaurant	Bakery	Bed & Breakfast

Figure 5. Guayas common venues

	Latitude	Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category	Confirmed cases	Confirmed deaths	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue	11th Most Common Venue	12th Most Common Venue	13th Most Common Venue	14th Most Common Venue	15th Most Common Venue
8	-0.058489	-78.328437	Zoologico	-0.071412	-78.356878	Zoo	62195.0	1829.0	1	Airport	Airport Lounge	Café	American Restaurant	Latin American Restaurant	Ice Cream Shop	Trail	Airport Service	Airport Terminal	Argentinian Restaurant	Bakery	Bed & Breakfast	Bus Station	Church	Zoo
9	-0.058489	-78.328437	El Riobambeñito	-0.065448	-78.361571	South American Restaurant	62195.0	1829.0	1	Airport	Airport Lounge	Café	American Restaurant	Latin American Restaurant	Ice Cream Shop	Trail	Airport Service	Airport Terminal	Argentinian Restaurant	Bakery	Bed & Breakfast	Bus Station	Church	Zoo
10	-0.058489	-78.328437	Iglesia De La Virgen Del Quinche	-0.110677	-78.296298	Church	62195.0	1829.0	1	Airport	Airport Lounge	Café	American Restaurant	Latin American Restaurant	Ice Cream Shop	Trail	Airport Service	Airport Terminal	Argentinian Restaurant	Bakery	Bed & Breakfast	Bus Station	Church	Zoo
11	-0.058489	-78.328437	La Riobambeñita	-0.065567	-78.361341	Latin American Restaurant	62195.0	1829.0	1	Airport	Airport Lounge	Café	American Restaurant	Latin American Restaurant	Ice Cream Shop	Trail	Airport Service	Airport Terminal	Argentinian Restaurant	Bakery	Bed & Breakfast	Bus Station	Church	Zoo
12	-0.058489	-78.328437	Típico Locro	-0.052883	-78.348857	Latin American Restaurant	62195.0	1829.0	1	Airport	Airport Lounge	Café	American Restaurant	Latin American Restaurant	Ice Cream Shop	Trail	Airport Service	Airport Terminal	Argentinian Restaurant	Bakery	Bed & Breakfast	Bus Station	Church	Zoo
13	-0.058489	-78.328437	Mickos	-0.058686	-78.358184	Ice Cream Shop	62195.0	1829.0	1	Airport	Airport Lounge	Café	American Restaurant	Latin American Restaurant	Ice Cream Shop	Trail	Airport Service	Airport Terminal	Argentinian Restaurant	Bakery	Bed & Breakfast	Bus Station	Church	Zoo
14	-0.058489	-78.328437	Cinnabon	-0.124263	-78.361259	Bakery	62195.0	1829.0	1	Airport	Airport Lounge	Café	American Restaurant	Latin American Restaurant	Ice Cream Shop	Trail	Airport Service	Airport Terminal	Argentinian Restaurant	Bakery	Bed & Breakfast	Bus Station	Church	Zoo
15	-0.058489	-78.328437	Salida Internacional	-0.124095	-78.359643	Airport	62195.0	1829.0	1	Airport	Airport Lounge	Café	American Restaurant	Latin American Restaurant	Ice Cream Shop	Trail	Airport Service	Airport Terminal	Argentinian Restaurant	Bakery	Bed & Breakfast	Bus Station	Church	Zoo
16	-0.058489	-78.328437	Sala VIP Nacional	-0.125521	-78.359863	Airport Lounge	62195.0	1829.0	1	Airport	Airport Lounge	Café	American Restaurant	Latin American Restaurant	Ice Cream Shop	Trail	Airport Service	Airport Terminal	Argentinian Restaurant	Bakery	Bed & Breakfast	Bus Station	Church	Zoo
17	-0.058489	-78.328437	Sala VIP Internacional	-0.123701	-78.360189	Airport Lounge	62195.0	1829.0	1	Airport	Airport Lounge	Café	American Restaurant	Latin American Restaurant	Ice Cream Shop	Trail	Airport Service	Airport Terminal	Argentinian Restaurant	Bakery	Bed & Breakfast	Bus Station	Church	Zoo
18	-0.058489	-78.328437	Juan Valdez Café	-0.124478	-78.361169	Café	62195.0	1829.0	1	Airport	Airport Lounge	Café	American Restaurant	Latin American Restaurant	Ice Cream Shop	Trail	Airport Service	Airport Terminal	Argentinian Restaurant	Bakery	Bed & Breakfast	Bus Station	Church	Zoo

Figure 6. Pichincha common venues

7. Conclusion:

All the results show us that is it not a good idea to visit Pinchicha and Guayas since these two provinces concentrated almost the 50% of the confirmed cases and 43% of

the confirmed deaths. In my opinion, these provinces were the most affected due to the fact that they are the most populated provinces and the airports are located in them.