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Epidemiological and Demographic Analysis of Suspected Covid-19 Cases Confirmed by PCR at Medical Center ISSEMyM Toluca from March 2019 to December 2022

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ABSTRACT

Objective: To describe the prevalence and incidence of suspected COVID-19 cases confirmed by PCR at Medical Center ISSEMyM Toluca from March 2019 to December 2022.

Materials and Methods: 3226 PCR tests for suspected COVID-19 cases were analyzed to obtain epidemiological and demographic data of the population, descriptive and inferential statistics analyses were carried out to find differences between population parameters.

Results: No differences between female and male respect to COVID-19 positivity were found (p-value = 0.9302). Age mean was 49 years old and the probability to get COVID-19 increase with age (p-value = 0.000). Hospitalization was the medical service with more frequency in patients with COVID-19 positive.

Conclusion: Age but no gender is a risk factor hospitalization due COVID-19., nonetheless vaccination appear to an efficient method to prevent hospitalization. Moreover, the dynamic pandemic in Mexico is no homogeneous across the territory.

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Introduction

COVID-19 disease is caused by a coronavirus named SARS-CoV-2, was first detected in Hubei, China [1-3]. Another two coronaviruses (SARS-CoV-2 and MERS-CoV) have been caused pandemics in 2003 and 2012 respectively however SARS-CoV-2 infection led to a pandemic never seen in the last century [2,4,5]. All these viruses and HCoV-OC43, HCoV- HKU1, HCoV-NL63, and HCoV-229E are members of β-coronavirus and have in common that produce respiratory infections in human [3]. In December 2019 were identified first reports of pneumonia associated with SARS-CoV-2, on March 2019 COVID-19 was declared as pandemic [2, 6]. The first case detected in México of COVID-19 was reported on February 17th and in March was announced by the Health Agency as the first deceased associated with SARS-CoV-2 infection [7].

Clinical manifestation of COVID-19 occurs after the incubation phase, however, about 80% of people infected are asymptomatic or have mild symptoms 2-14 days after infection. On the other hand about 15% come severe and 5% are critical with the need of mechanical ventilation [8,9]. Clinical manifestations of this disease include rhinorrhea, anosmia, diarrhea, chest pain, headaches, fever in mild and moderate disease and hypoxemia, respiratory and renal failure, and acute respiratory distress in severe illness [4, 8]. Pattern transmission of COVID-19 is associated with droplets spread by cough or sneezing that carry the SARS-CoV-2 in people infected, however, there are other transmission ways reported such as aerosol transmission or contact with contaminated surfaces [6]. Diagnostic of SARS-CoV-2 is carried out by detection of viral genome by RT-qPCR on nasopharyngeal swabs [2,10,11]. COVID-19 in México, rapidly led to an increment in new cases after the first months of the pandemic and continuous today. Toluca Valley is the fifth metropolitan area in Mexico. however, is not clear the impact of COVID-19 on medical services in the

region and this with national level respect to factors such as age or gender. The aim of this research is to contribute to solve this situation through data analysis of PCR carried out in the laboratory of Medical Center ISSEMyM Toluca.

Materials and Methods

Data collection

All samples of suspected COVID-19 cases sent to the laboratory of Medical Center ISSEMyM Toluca for PCR detection of SARS-CoV-2 genome from March 2020 to February 2022 (2 years) were collected and saved on a database previous approval by the hospital Bioethics Committee under number 043/21 permission and supported with project 6741/2022 CIB, SIyEA, UAEMéx. Extracted data from laboratory results for SARS-CoV-2 included gender, age, PCR outcome, and medical service.

Data Analysis

Total number of tests was quantified, and its result was analyzed as positive if the viral genome was detected, or negative if viral genome was not detected. Based on the subtracted data, the population was stratified in age groups of 10 years from 20 to 99, also population was divided in adult and older adults (60 or more). Respect to gender it was divided into male and female, and PCR outcome was categorized in positive and negative.

All the PCR tests that were requested by the medical service were related with the demographic data population to recognize the possible outcome of COVID-19 severity in each patient who attended Medical Center ISSEMyM Toluca in the period of study. To comprise the pandemic dynamics in the region of Toluca Valley, the obtained data were compared with data from public databases of COVID-19 at regional level or with a state with high international tourism catchment, border states, and national level.

Statistical Analysis

The population characteristics were studied with nondescriptive statics to get the mean age, the total number of positive cases, the proportion of gender with COVID-19, and the frequency of medical services that requested PCR tests. A chi-square test was carried out to prove if there are differences between gender or age, and the COVID-19 positive test. Additionally, regression models were carried out to establish if age is related to COVID-19 test positive. $P < 0.05$ value was considered as statistically significant.

Results

A total of 3226 PCR test results from March 2020 to February 2022 were collected, filtered, and analyzed. The mean age of the population in this study was 49 years old. Over a half of the analyzed population (5 out of 10) was positive for COVID-19 for the time frame covered by this study, mostly of them (74%) were diagnosed during the first year.

No significant differences were found in gender between males and female with positivity of COVID-19 detected by PCR in the two years of the pandemic (p-value = 0.930214, for total population) (Table 1). Furthermore, the relative risk of being positive is similar for female and male in each medical service area evaluated for the two years except for urgency in 2020 (p value = 0.0470) as seen in Table 1.

Table 1: Analysis of Factors Associated to COVID-19 PCR Test from 2020 to 2021 in the Laboratory of Medical Center ISSEMyM Toluca. Relative Risk was Calculated between Female and Male for Each Medical Service. * Indicate Statistical Differences between Groups.

Variable	Out Patient		Urgency				In Patient		
	Positive number /%	Negative number /%		Positive number /%	Negative number /%		Positive number /%	Negative number /%	
YEAR 2020									
GENDER			Relative risk			Relative risk			Relative risk
MALE	25/1.07%	123/ 5.25%	0.95	95/ 4.05	192/ 8.19%	1.10	615/ 26.24%	274/ 11.69%	1.05
FEMALE	30/1.28%	117/ 4.99%	1.20	86/ 3.67%	247/ 10.54%	0.780	365/15.57%	175/7.47%	0.97
p VALUE		0.4381			0.0470			0.5311	
AGE RANGE	Total number		Age group			Age group			Age group
20-29	5	44		19	65		25	13	
30-39	8	58		44	126		97	42	
40-49	16	57		59	119		192	79	
50-59	15	46		29	72		252	111	
60-69	8	10	Older adults relative risk 1.37	12	18	Older Adults relative risk 1.13	221	105	Older adults relative risk 0.96
70-79	1	5		5	10		112	53	
80-89	1	0		2	6		38	14	
90-99	0	0		1	0		5	0	
	%	sd		%	sd		%	sd	
POSITIVITY RATIO	2.06	2.01		6.96	3.7		40.34*	8.02	
p= 0.000018									
YEAR 2021									

GENDER	Positive number /%	Negative number /%	Relative risk	Positive number /%	Negative number /%	Relative risk	Positive number /%	Negative number /%	Relative risk
MALE	1/ 0.13%	28/ 3.56%	0.85	19/ 2.42%	34/ 4.33%	1.00	216/ 27.48%	148/ 18.83%	1.10
FEMALE	5/ 0.64%	23/ 2.93%	5.17	26/ 3.31%	47/ 5.98%	0.99	132/ 16.79%	107/ 13.61%	0.93
p VALUE		0.0764			0.9785			0.9785	
AGE GROUP	Total number		Age group	Total number		Age group	Total number		Age group
20-29	0	4		6	14		9	17	
30-39	0	5	Adult	7	13	Adult	39	22	Adult
40-49	3	9		21	31		70	48	
50-59	2	17		11	20		100	67	
60-69	1	7	Older adults relative risk 0.66	0	2	Older adults relative risk 0.63	72	57	Older adults relative risk 0.97
70-79	0	3		0	0		40	26	
80-89	0	0		0	0		15	12	
90-99	0	0		0	0		2	1	
	%	sd		%	sd		%	sd	
POSITIVITY RATIO	0.8	1.84		2.4	4.17		42.28*	24.87	
p VALUE	0.0000055								

A tendency to increase the risk of getting COVID-19 with age was observed (logistic regression p-value < 0.05), this analysis was carried out only in the first year of the pandemic, to avoid the effect of to the vaccination campaign that started in early 2021 in México which started with older age people and health care personnel. Interestingly, the relative risk to COVID-19 positive was higher in older people in urgency and out-patient medical service but not at in-patient services. This tendency in relative risk was reverted for the 2021 year (Table 1). These results, together with the comparison between age groups from young adults to old adults (p-value < 0.5) show that old people get the COVID-19 in a more proportion than young adults and middle-aged adults.

Medical service with the greater number of positives cases in both years was in-patient, this service had 3.6 more cases than out-patient service and up to 2.26 more than emergency service in the first year, a similar behavior was also observed in the second year. Emergency was the second service with more reported COVID-19 cases, nonetheless, this tendency is reverted in the first bimester of 2022 in which this service reached a great number of COVID-19 cases. In all cases, out-patient was the service with the lowest number of confirmed cases.

During the period of this study were detected according to the positivity in percentage five peaks, two of them very close to each other coinciding with the first wave in the country, moreover the other 3 peaks are according to the other 3 waves reported by Health Institute, see figure 1. The first wave was observed from April to September 2020, and it has two peaks one in April and other in July, the second wave was observed from February to April 2021 with a peak in March, the third in august 2021 and the last wave in January 2022, this has the highest positivity rate, however the total number of in-patient was the lowest.

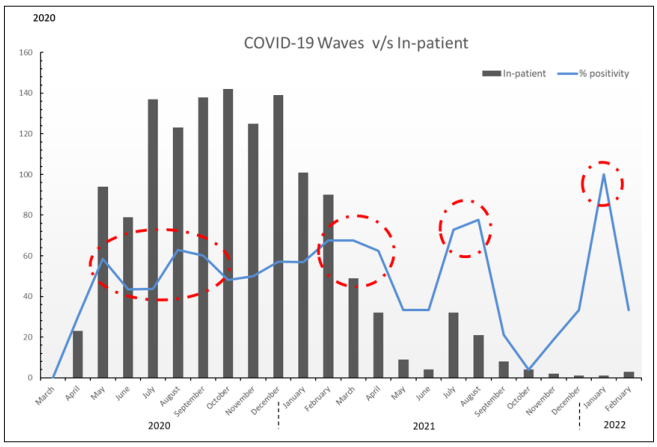

Figure 1: Epidemiological Waves Identify from 2020 to 2022. Blue Line Shows the Calculated Percentage of Positivity from the PCR Test at ISSEMYM, Bars Represent the Total Number In-Patients Per Month. Red dot Circles Represent the Wave at National Level Reported by Health Institute.

The pandemic behavior during the 2020, 2021, and 2022 first bimester was like the reported at the country level, see figure 2, with a relatively constant number of positive cases in the first year of pandemic, a tendency to decrease the number of cases in the first semester of 2021 and a new increase of COVID-19 cases July of 2021 and the first semester of 2022, however a general tendency to decreases in the total number of cases was observed from the last semester of 2020 and over. In contrast, the dynamic in south border states and high attraction of international tourism states was different o report at national level see Figure 2.

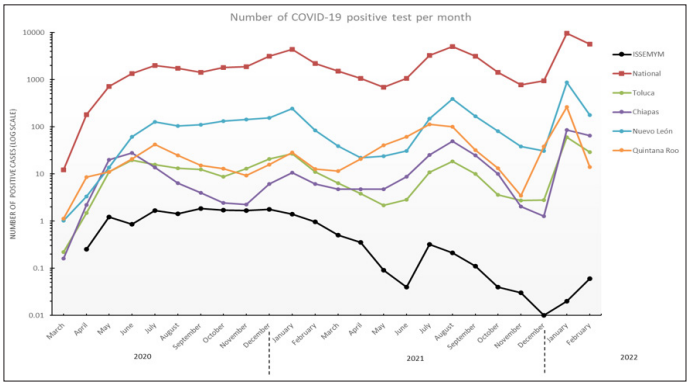

Figure 2: Behavior of COVID-19 Confirmed Cases by PCR Test from 2020 to February 2022 at Local, State, and National Level. Chiapas and Nuevo León Represent States from Border at South and North Respectively. Toluca Represents the Local Region is Establishment the ISSEMyM.

Discussion

In state of México has been reported to March 2022 491,000 confirmed cases of COVID-19 and 34,569 defunctions related to the disease, at local level Toluca Valley is one of the regions with the highest number of positive cases, for this reason, various specialized health care units have been designed as COVID-19 hospitals [12]. ISSEMyM is one of the health Institute that provides health services to the population in Mexico's Sate and its hospitals such as Medical Center ISSEMyM Toluca were cataloged as COVID-19 hospital giving services of diagnostic, treatment, and health care to people infected with SARS-CoV-2 [13]. In this paper is shown that over the 50% of the people that received health care due to symptoms related to COVID-19 were positive for SARS-CoV-2 detected by PCR, all the population analyzed satisfied the definition of a suspect case as a requirement to send a nasopharyngeal sample to the laboratory of ISSEMyM. In general, a suspected case is defined as a person who meets epidemiological or clinical criteria.

Emergency medical attention related to COVID-19 includes pneumonia, fever and three or more signs of symptoms, previous studies have been reported that 67% of the population with COVID-19 symptoms received health care only 15.4% of them were tested for SARS-CoV-2 and only 23.2% were confirmed as positive by antibodies test [14]. In this paper we found a positivity rate of 50% in PCR test for SARS-CoV-2 carried out in the laboratory of Medical Center ISSEMyM Toluca, this is more than twice, probably this difference is due to the method selected to report a positive case, PCR has been chosen as the gold standard for detection of SARS-CoV-2 infection and is more sensitive than serology test such as IgG/IgM detection tests, and could be complemented with computed tomography to improve the diagnosis [15-18].

Voluntary isolation related to signs or symptoms of COVID-19 or for contact with a suspected case represents a valuable resource to fight this pandemic, in México, near to 48% of the population reported isolation during 2020, by the other hand, 51.2 % was not isolated even though they were considered to be suspected cases, this probably increase the number of hospitalization during the first year of pandemic in México, we found that approximately 40% of the total cases analyzed were associated to hospitalization, similar results has been reported in high demographics city such as New York [19, 20]. Moreover the highest number of hospitalizations registered, corresponds with the reopening of the non-essential activities and services after a period of all no essential activities, even an increased in deceased by COVID-19 was registered in the same time in México [21, 22].

With respect with gender differences in patients who attend health care services related to COVID-19, no significative differences between males and females were found in the global (2020 to 2022) and per year analysis, this is in concordance with studies realized at the early stage of the pandemic in which also symptoms are comparable between both genders [23]. Other studies had been reported no differences between males and females respect to COVID-19 positivity; nevertheless differences respect to levels of ACE2 expression were found in both genders, being in males who have more ACE2 receptor expression than females and could be considered a COVID-19 risk factors, furthermore males have more risk factors associated with COVID-19 hospitalization and mortality, risk factors such as hypertension, age, diabetes mellitus, and obesity that play a crucial role in COVID-19 progression to a severe illness [24-29].

The mean age obtained was 49.35 years old this is similar to reported in other researchers, from 40.8 to 35.8 in early 2020 in USA, 51 age in 2020 reported in China (27) and 49.1 years reported in a review from 5 published articles [30,31]. Aging is related to COVID-19 progression and severity, old people are most susceptive to hospitalization and get a severe disease(6), we found that 67% of the patients hospitalized were 50 or more years old, also the probability of being COVID-19 positive increased with age, this is on concordance with age related risk an mortality in people infected with SARS-CoV-2 [32]. Furthermore, survival rate in hospitalized patients is higher those aged <50 years [33].

Interestingly the pandemic behavior is not homogeneous in México, the regions of the center and some densely populated cities have a similar behavior respect to number of positive cases per month and were similar to the national mean, however regions with lower population o with high activity for tourism have different behavior reporting lest cases or with an irregular fluctuation. This could be explained first, México is one of the most populated countries however is not densely populated due to territorial extension, countries with less population are more densely populated such as UK, Japan, Portugal or even countries in America as Panama or Guatemala [34]. Second the distribution of population is not homogeneous, more than 30% of the is concentrated in only a few of regions principally in the region center [35]. This could lead to an unequal rate in the number of COVID-19 positive cases and hospitalization for example. Third, the politics implemented by the government and Health Institute respect to no restrictions to foreign travel in 2020 -Mexico was the third most visited country, with 25 million tourists- and non-quarantine for them, contributed to the increase of daily cases in regions with a high influx of tourists, especially from abroad [21].

This study had some limitations related to the data acquisition, in which data about if the people have been vaccinated is not present due to ins not a requirement for laboratory tests in the Health Center, this is one of the reasons for the data here were shown must be carefully interpreted. Another point to be considered is that ISSEMyM is not the only Health Institute providing services in the Toluca Valley region, IMSS (Mexican Institute for Social Security), ISEM (México State Health Institute), and private health care services, provide these services in the region, however, ISSEMyM medical center was one of the hospitals designed for

COVID-19 diagnostic and health care attention-related with the pandemic in the region of Toluca Valley [36].

Conclusion

Age was a significant risk factor for hospitalization due to COVID-19 at Medical Center ISSEMyM, this was seen in the first year evaluated in the present study, nonetheless, vaccination appears to be an efficient method to prevent hospitalization for COVID-19. Males and females have the same probability, so gender was not related to increase hospitalization in the period studied. Finally, the pandemic behavior in México is very different in each region probability due to differences in population density, health policies applied in each region, and the interaction between these.

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