



Update of the Evolution of SARS-CoV-2 Infection, COVID-19, and Mortality in Mexico Until May 15, 2020: An Ecological Study

**Nicolás Padilla-Raygoza^{1*}, Cuauhtémoc Sandoval-Salazar²,
Luis-Antonio Díaz-Becerril¹, Vicente Beltrán-Campos³,
Daniel Alberto Díaz-Martínez⁴, Efraín Navarro-Olivos⁴,
María de Jesús Gallardo-Luna⁴, Francisco J Magos-Vazquez⁴
and Ma Guadalupe León-Verdin⁴**

¹*School of Medicine, University of Celaya, Celaya, México.*

²*Division of Health Sciences and Engineering, Department of Nursing and Obstetrics, Campus Celaya-Salvatierra, University of Guanajuato, Celaya, México.*

³*Division of Health Sciences and Engineering, Department of Clinical Nursing, Campus Celaya-Salvatierra, University of Guanajuato, Celaya, México.*

⁴*Ministry of Health, Guanajuato State, Guanajuato, Mexico.*

Authors' contributions

This work was carried out in collaboration among all authors. Authors NPR and CSS designed the study and wrote the manuscript. Author LADB clean the database and participated in writing the manuscript. Author VBC reviewed the database and participated in writing the manuscript. Author DADM reviewed the literature and analyzed the data. Author ENO obtained the information of SINAVE/DGE and participated in writing the manuscript. Author MJGL obtained the information from WHO and other references and participated in writing the manuscript. Author FJMV designed the tables and wrote the manuscript. Author MGLV reviewed the statistics and writing in English and the writing the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Disease for a novel coronavirus has been a big public health challenge around the world in the past several months. The aim of this study is to describe the epidemic and report the number of confirmed cases and deaths of disease for a novel coronavirus in Mexico until May 15, 2020.

Study Design: Ecological study.

Place and Duration of Study: Registries of confirmed cases for disease for a novel coronavirus in Mexican population during January and until May 15, 2020, from National System of Epidemiological Surveillance/ General Direction of Epidemiology/ Secretary of Health, Mexico.

Methodology: Based on the database of confirmed cases of disease for a novel coronavirus by Secretary of Health in Mexico, we collected data on age, gender, and deaths, and co-morbidities. As of May 15, 2020, 45,032 cases have been identified in Mexico.

Results: The first confirmed case in Mexico has been identified on January 8, 2020 and the incidence has been rising from the end of February and throughout March. The early confirmed cases were imported cases resulting from travel to USA, Italy, Germany, Spain, France and Singapore. No one travelled to China. No cases of community transmission have been reported. The cause-specific mortality rate was 10.59% and the possibility to death is three times more if comorbidities are in the patient.

Conclusion: The frequency of confirmed cases of disease for a novel coronavirus in Mexico are concerning and the health authorities in Mexico are waiting for the peak of the epidemiological curve to occur in May. The mortality is high with co-morbidities.

Keywords: SARS-CoV-2; COVID-19; infection; population; Mexico.

1. INTRODUCTION

On December 31, 2019, a case of pneumonia was reported in the World Health Organization office and some cases had occurred of pneumonia of unknown cause and the facets worked or went to the local food market from the Huanan Sea of Wuhan, Province Hubei, China [1-5]. By January 10, 2020, the first deceased occurred in China due to this infection and the outbreak is declared a Public Health emergency of international interest on January 30th, 2020 [6]. On February 7, 2020, the cause of idiopathic pneumonia was reported to be a new coronavirus, and the WHO called it 2019-nCoV and later it was called SARS-CoV-2 [7] and the disease caused by the coronavirus was called Coronavirus Infectious Disease (COVID -19) on February 11th, 2020 [5].

After a month, the virus was isolated, its genome was sequenced and its morphology was described; on January 12th, 2020, the virus genome was shared with WHO by the Chinese Center for Disease Control and Prevention [8]. Zhou et al. [9], reported that the causer of COVID-19 shares 79.5% of the SARS-CoV sequence; also, it uses the same cell entry receptor, angiotensin-converting enzyme-2, as SARS-CoV.

Zhu et al. [10], reported the cytopathic effects and morphology and it is a member of a family of

coronaviruses that infect humans; grew more in human airway epithelial cells than tissue culture cells, suggesting the potential for increased infectivity.

COVID-19 patients who present with a comorbid condition may have an increased risk of deterioration and should therefore be admitted to a designated unit for close monitoring in accordance with the WHO guidelines for screening and triage [11].

In a series of 41 patients infected with SARS-CoV-2, 32% had some underlying pathology, diabetes 20%, hypertension 15%, cardiovascular disease 15%, chronic obstructive pulmonary disease (COPD) 2% [12].

Mexico is located in North America, with a total population for 2015 of 119,938,473 inhabitants, there are 94.4 men for every 100 women [13]. It has 32 states with important differences in their geographical and population characteristics [14]. For suspected cases of COVID.19, the population goes to the public health service.

The objective was to describe and analyze deaths from confirmed cases of COVID-19 and co-morbidities on deaths of patients with COVID-19, in Mexico.

2. METHODOLOGY

An analytical ecological study in the Mexican population is designed, with data published by

the General Directorate of Epidemiology and the National Epidemiological Surveillance System of the Ministry of Health on May 15, 2020 [15]. The data are available for all with only limited data.

Data were collected on age, gender, symptom onset date, RT-PCR test result, date of death, if applicable, as well as associated factors or diseases (smoking, obesity, pneumonia, cardiovascular disease, asthma, COPD, diabetes, hypertension, chronic kidney disease. Immunosuppression) [15]. The dates of confirmed cases were from the beginning of symptoms.

A suspected case is a patient who, in the previous 14 days, has presented fever and / or cough, headache, Myoarthralgia, dyspnea and has had contact with a confirmed case or has traveled to China, Europe or the USA and becomes confirmed when in addition of the above, it presents positive Real Time- Polymerase Chain Reaction (RT-PCR) test [16]. To establish whether the case was confirmed or ruled out, it was based on the result of the RT-PCR, recommended by the WHO [17]. In Mexico, only subjects with clinical data are submitted to RT-PCR test for SARS-CoV-2.

For the statistical analysis, variables were crossed with confirmed cases, associated diseases and deaths. Odds Ratios (OR) and 95% confidence intervals were calculated to find an effect between gender, underlying pathologies and the possibility of dying. Logistic regression models were designed for death and being a case of COVID-19, adjusted by age group and sex, for each of the morbidities. Statistical analysis was performed on STATA @ 13.0 (Stata Corp., College Station, TX, USA).

3. RESULTS

The sample of public records of confirmed and discarded cases of the General Directorate of Epidemiology, of the National System of Epidemiological Surveillance of the Ministry of Health of Mexico, was made up of 134, 553 records of which 45,032 (33.44%) were confirmed cases and 89,631 (66.56%) were negative for the RT-PCR test [15].

For confirmed cases the age range was from 0 to 114 years with a mean of 46.80 ± 15.79 years; 18,852 (41.86%) were females and 26,180 (58.14%) were males.

The distribution of confirmed case by Mexican States is show in Table1. The first place is for Mexico City (27.66%), Mexico State (16.81%), Baja California (6.75%) and Tabasco (4.83%).

Table 1. Distribution by Mexican States, confirmed cases of COVID-19 (n=45,032) [13]

States	n	(%)
Aguascalientes	443	(0.98)
Baja California	3,040	(6.75)
Baja California Sur	439	(0.97)
Campeche	280	(0.62)
Mexico City	12,456	(27.66)
Chiapas	533	(1.18)
Chihuahua	874	(1.94)
Coahuila	644	(1.43)
Colima	58	(0.13)
Durango	150	(0.33)
MexicoState	7,570	(16.81)
Guerrero	743	(1.65)
Guanajuato	658	(1.46)
Hidalgo	748	(1.66)
Jalisco	767	(1.70)
Michoacán	768	(1.71)
Morelos	1,021	(2.27)
Nayarit	287	(0.64)
Nuevo León	776	(12.84)
Oaxaca	369	(0.82)
Puebla	1,338	(2.97)
Querétaro	361	(0.80)
Quintana Roo	1,257	(2.79)
Sinaloa	1,814	(4.03)
San Luis Potosí	399	(0.89)
Sonora	757	(1.68)
Tabasco	2,177	(4.83)
Tamaulipas	890	(1.98)
Tlaxcala	509	(1.13)
Veracruz	1,700	(3.78)
Yucatán	1,025	(2.28)
Zacatecas	181	(0.40)
Total	45,032	(100.00)

Source: SINAVE/DGE [13]

The first confirmed case in Mexico was on January 8, 2020 and thereafter the largest number of confirmed cases were from April 19 to May 10, 2020 (Fig. 1). The first cases were imported, but now community cases are increasing. The decrease in confirmed cases on May 11-14 may be art efects due to delayed delivery of diagnostic test results. From March 28, with 848 cases and until May 15, 2020, with 45,032 cases, the mean increase by day was 110.63%.



Fig. 1. Map of Mexico

Source: *México Desconocido. La República Mexicana vista desde un satélite. Google maps* © <https://www.mexicodesconocido.com.mx/mapa-de-mexico.html>

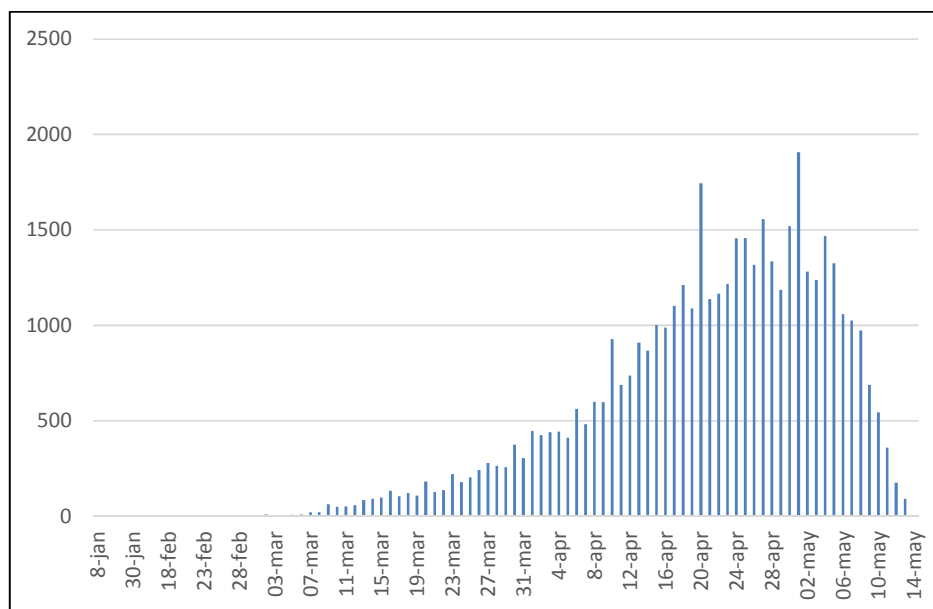


Fig. 2. Distribution of confirmed cases by day (n=45,032)[13]
 Source: SINAVE/DGE [13]

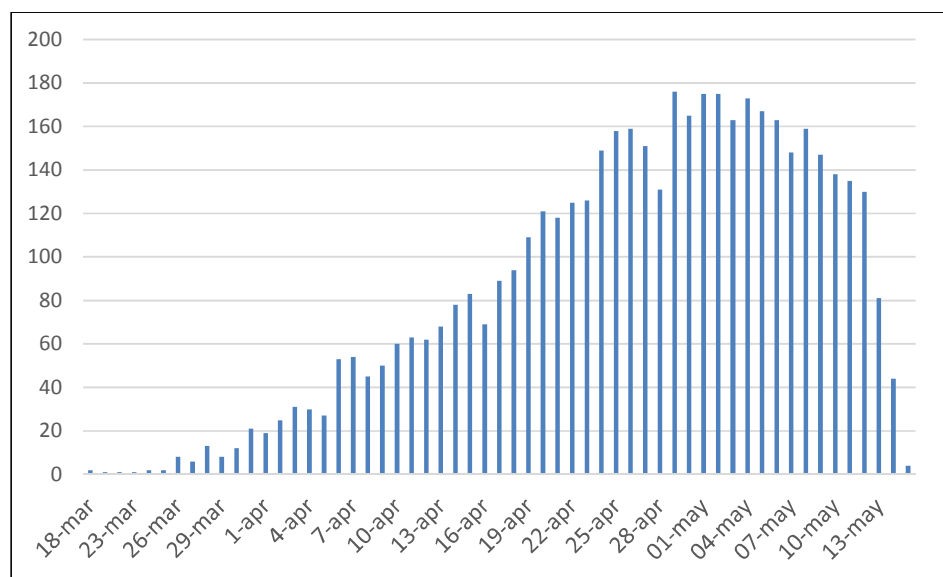


Fig. 3. Distribution of deaths by day (n=4,767) [13]
 Source: Secretary of Health [13]

Fig. 3 shows the deaths reported by COVID-19 per day. On March 28, 200, a specific mortality rate of 1.9% was reported, with 16 deaths among 848 confirmed cases. For May 15, 2020, the specific mortality rate was 10.59% with 4,767 deaths among 45,032 confirmed cases.

Table 2 show the distribution of deaths among confirmed cases by age group and gender. The

deaths predominated in males (68.14%) and from 60 or more years old (49.57).

When analyzing the data of confirmed cases, deaths due to co-morbidities, different records were eliminated because it was unknown whether they suffered from them or not. The number of deleted records is shown in Table 3.

OR for the association between deaths and co-morbidities, it is reported that those who died from COVID-19 were three or more times more likely to have had diabetes, hypertension, COPD and chronic kidney disease; for cardiovascular disease, immunosuppression and obesity, the OR were less than 3, but continue to show an effect of these pathologies on death. For smoking, the effect was almost null on death; asthma prevented death in confirmed cases (26%) (Table 4).

4. DISCUSSION

The samples reported as confirmed cases of COVID-19 were 45,032 with 4,767 deaths, with a specific rate of 10.59%. COVID-19 deaths predominated in men ages 60 or higher years. Globally, the WHO reported a mortality from COVID-19 of 6.34% [18].

According to the same WHO report, Italy had a specific mortality rate of 12-80%, the United Kingdom of 12.78%, Spain 10.3%, the United States of America, 3.97% and Brazil of 2.96% [18].

The case-specific mortality in Mexico was 10.59% and according to the WHO report of May 6th, 2020, overall the case-specific mortality was 6.9%, for the Americas region it was 5.38% and for Europe 9.3% [19].

There is currently evidence that mortality rates are higher in men than in women, as indicated by the Italian Institute of Health in one of its reports, where of 23,188 deaths, approximately 70% of these were men, as well as in China and South Korea [20]. In Mexico, mortality was higher in men (68.14%) than in women.

The incidence of SARS-CoV-2 infection has been seen to be more frequent in adult male patients between the ages of 34 and 59, and it has also been observed that people 60 years of age or older and with comorbidities represent severe cases that may present coinfections [21]. Among the confirmed cases in Mexico, mortality between 20 and 59 years was 50.55% and 49,115 in those over 60 years of age.

In the United States, the National Center for Health Statistics, until May 9th, 2020 reports that

Table 2. Distribution of deaths on confirmed cases of COVID-19, by gender and age group, in Mexico (n=45,032)

Variable	Deaths		Non-deaths	
	n	%	n	%
Gender				
Female	1,519	31.86	17,333	43.05
Male	3,248	68.14	22,932	56.95
Age group (years)				
0-5	11	0.23	244	0.61
6-11	3	0.06	204	0.51
12-49	1,185	24.86	24,755	61.48
50-59	1,205	25.28	7,917	19.66
60 or higher	2,363	49.57	7,145	17.74

Table 3. Missing data in co-morbidities and whether confirmed COVID-19 patients in Mexican Sample from the start until May 15, 2020

	Confirmed COVID-19 patients n	%
Diabetes	338	7.51
Hypertension	338	7.51
COPD	336	7.46
Asthma	348	7.73
Cardiovascular disease	346	7.68
Immunosuppression	345	7.66
Chronic kidney disease	352	7.82
Smoking	337	7.48
Obesity,	376	8.35
Pneumonia	3	0.67

Table 4. Distribution of deaths by cases confirmed of COVID-19, by co-morbidities in Mexico

	Confirmed cases COVID-19 (n=45,032)				Logistic regression adjusted by:	
	Deaths		Non-deaths		Age group	Gender
	n	%	n	%		
Diabetes						
Yes	1,848	39.08	6,486	16.23		
No	2,881	60.92	33,479	83.73		
OR (CI95%)	3.31 (CI95% 3.11 to 3.53)				2.05 (1.92 to 2.20)	3.33 (3.12 to 3.55)
Hypertension						
Yes	2,014	42.60	7,740	19.37		
No	2,714	57.40	32,226	80.63		
OR (CI95%)	3.09 (2.90 to 3.29)				1.76 (1.65 to 1.89)	3.13 (2.94 to 3.34)
COPD						
Yes	293	6.20	715	1.79		
No	4,431	93.80	39,257	98.21		
OR (CI95%)	3.63 (3.16 to 4.17)				1.78 (1.54 to 2.06)	3.76 (3.27 to 4.33)
Asthma						
Yes	113	2.39	1,284	3.21		
No	4,611	97.61	38,676	96.79		
OR (CI95%)	0.74 (0.61 to 0.90)				0.89 (0.73 to 1.09)	0.80 (0.66 to 0.97)
Cardiovascular disease						
Yes	277	5.87	942	2.36		
No	4,443	94.13	39,024	97.64		
OR (CI95%)	2.58 (2.24 to 2.96)				1.45 (1.25 to 1.67)	2.59 (2.26 to 2.98)
Pneumonia						
Yes	3,595	75.41	9,731	24.17		
No	1,172	24.59	30,531	75.83		
OR (CI95%)	9.62 (8.98 to 10.32)				7.23 (6.73 to 7.77)	9.38 (8.75 to 10.06)
Immunopression						
Yes	156	3.30	599	1.50		
No	4,565	96.70	39,367	98.50		
OR (CI95%)	2.25 (1.88 to 2.69)				1.85 (1.53 to 2.23)	2.31 (1.93 to 2.76)

Chronic kidney disease				
Yes	365	7.73	759	1.90
No	4,355	92.27	39,201	98.10
OR (CI95%)	4.33 (3.81 to 4.92)		3.03 (2.65 to 3.48)	
Obesity				
Yes	1,328	28.18	8,099	20.28
No	3,385	71.82	31,844	79.72
OR (CI95%)	1.54 (1.44 to 1.65)		1.58 (1.47 to 1.69)	
Smoking				
Yes	459	9.72	3,362	8.41
No	4,265	90.28	36,609	91.59
OR (CI95%)	1.02 (1.01 to 1.02)		1.01 (1.01 to 1.02)	

patients with comorbidities of all ages are 49,770; stratifying each comorbidity and reporting a specific mortality of 14.27% in people with diabetes, 7.34% for kidney failure, 43.41% for pneumonia, 3.45% for cardiovascular disease, 7.72% for COPD, 2.65% for obesity and 20.22% for hypertension [22]. In Mexico, among the confirmed cases of diabetes, mortality was 39.08; 42.60% among those with hypertension, 75.41% in those with pneumonia, 28.18% in those with obesity, 9.72% among smokers, 5.87% among those with cardiovascular disease, 7.73% among those who reported chronic kidney disease, 6.20% among those with COPD, 3.30% among those with some type of immunosuppression and 2.39% among those with asthma (Table 5). In general, the specific death rate from co-morbidities was higher than that reported in the USA.

There are limitations to this study, since the publicly available database does not contain data about severity of the infection or prognosis of the evolution of the disease,

5. CONCLUSION

Mortality in Mexico among confirmed cases of COVID-19 is higher for adult men, over 20 years and older adults. Regarding the underlying pathologies, mortality was higher in Mexico than in other affected countries. In this population it was three times more likely to die having diabetes and confirmed COVID 19 and six times more likely to die by having diabetes but not confirmed for COVID-19. same for other pathologies except asthma.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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