

Mortality due to COVID-19 and Risk Factors at Pachuca's General Hospital in the State of Hidalgo, Mexico

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ABSTRACT

Aim: To estimate the risk of death secondary to COVID-19 infection and to identify the factors associated with these deaths at the Pachuca General Hospital, Hidalgo, Mexico.

Material and methods: The information was obtained from the daily report of patients whose were attended at Hospital General de Pachuca for respiratory disease compatible with COVID-19 from March 2020 to March 2021, the information obtained was captured electronically in a database by the epidemiology department of the institution. A cross-sectional design was used. Patients who died secondary to complications of respiratory disease were compared with survivors of the same disease. Pearson's Chi-square was used to estimate the differences between the deceased and the survivors. For the crude risk of dying from COVID-19, the odds ratio was used, and for the adjusted risk, non-conditional logistic regression was used, a trend analysis was performed, with the corresponding trend Chi-square test, all calculations were made with 95% confidence.

Results: The information of 4418 people with respiratory disease was analyzed. During the study period, 647 people died of COVID-19, corresponding to 14.64%. Of the population, 50.97% were men, their mortality was 18.92% and that of women was 10.22% ($P < 0.05$). Variables associated with dying from complications from COVID-19 were found to be male (OR 2.05, 95% CI 1.71-2.45), being 40 years old or older (OR 9.62, 95% CI 7.30-12.86), having a positive RT-PCR result (OR 3.53 95% CI 2.83-4.43), and being a carrier of a Chronic Degenerative Disease (OR 4.79 95% CI 4.01-5.73).

Conclusions: The results indicate that the risk of dying from COVID-19 is related to male patients, at the older age of the patients, having a positive RT-PCR and suffering from at least one chronic degenerative disease.

Keywords: Age distribution, comorbidities, COVID-19, deceased, SARS-CoV-2, sex.

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I. INTRODUCTION

COVID-19 caused by the SARS-CoV-2 virus of probable zoonotic origin initially described in Wuhan, capital of Hubei province in China, and whose transmission is carried out from person to person. On March 11, the World Health Organization declared it a pandemic [1]-[3]. The first case of COVID-19 was detected in Mexico on February 27, 2020 [4]. In the state of Hidalgo, the disease was first detected on March 19th, 2020, when the first two cases were officially confirmed, detected in the municipalities of [5]. SARS-CoV-2 causes progressive pneumonia [6]. Patients infected by SARS-CoV-2 present different clinical pictures, starting with

asymptomatic subjects and those with a mild clinical picture, [7]. Patients with mild disease do not need hospitalization and are managed at your home. However, the disease can progress to the most serious manifestation, pneumonia. The disease is classified as mild, which occurs in 81% of those infected, moderate in 14%, and 5% in severe pneumonia. These patients usually present shock to multi-organ failure, which require mechanical ventilation. The studies [8], [9] found higher mortality among patients with systemic arterial hypertension (SAH), diabetes mellitus (DM), hyperlipidemia and coronary artery disease. When people have one or more chronic degenerative diseases (CD) the condition of the general level of health can be severely affected, and this fact becomes a greater challenge if patients have poor

pharmacological management or unhealthy lifestyle. The presence of CD complicates the care and pronostic of people infected with SARS-COV-2. Having greater the difficulty of management if people have multiple diseases [10]. The presence of CD in patients with COVID-19 is seen as a therapeutic challenge, especially if they have to be hospitalized, due to a more difficult treatment trying to control at the same time comorbidities and the evolution of COVID-19 as an ailment [11]-[14]. Some studies reported that SAH was the most frequent pathology in hospitalized COVID patients, followed by DM, obesity, chronic kidney disease (CKD) and chronic obstructive pulmonary disease (COPD). All of these illnesses were associated with an increase on mortality from COVID-19. Similar results were reported [15] where SAH, obesity and COPD were the most frequent CD [16]. They found SAH, DM, and heart disease to be the most frequent CD related to COVID-19 mortality. Similar findings have been found in other studies [8], [17]-[22] found that SAH, DM, cardiovascular disease, and chronic lung diseases were also associated with mortality from COVID-19.

Regarding the sex of the participants, the studies found differences in survival [22], compared the differences between the sexes finding differences in survival rate, with women being the ones with the longer survival time [23]. found that there is a higher mortality among males and that this mortality has a similar behavior among the different age groups [24]. They found differences between the sexes, with higher mortality among men. On the other hand, age is an important risk factor for severe disease, complications, and death [25]-[27]. Among the more than 44,000 confirmed COVID-19 cases in China, the fatality rate was highest among older people: ≥ 80 years (14.8%), 70-79 (8.0%), 60-69 (3.6%), 50-59 (1.3%), 40-49 (0.4%), < 40 years (0.2%). Early epidemiological data from the United States suggest that case fatality was highest in people ≥ 85 years (with a prevalence of 10% to 27%), followed by ages 65-84 years (3% to 11%), 55-64 years with prevalence ranging from 1% to 3%, and $< 1\%$ for ages 0 to 54 years [28]. In relation to the RT-PCR study, there are studies such as the one of [29]. Where their results showed a higher frequency of positive RT-PCR results were higher in patients who died. Similar results were obtained in the study by [30]. So, this laboratory test was a good predictor for mortality in patients with COVID-19. The aim of this research is to estimate the risk of death secondary to COVID-19 infection through the information registered in the database created from the daily report of patients requesting medical attention at the General Hospital Pachuca carried out by the epidemiology service for the period from March 2020 to March 2021 and identify the bio sociodemographic variables associated with the risk of dying from COVID-19.

II. MATERIAL AND METHOD

The study was carried out at the General Hospital of Pachuca, Hidalgo, Mexico. The used design was retrolective cross-sectional, analyzing file data of patients who came to the emergency department requesting medical attention for respiratory tract infection. The time for collecting the information began on March 2020 and finished on the same month of 2021. The information of the participants, both

those who died, as well as the survivors, were identified and accounted for from all the services at the hospital. Patients who died or survived at the time of the study and who were classified as COVID-19 positive were diagnosed through a positive RT-PCR laboratory test, as well as, by the clinical sings compatible with the disease. For casualties, COVID-19 was registered as the cause of decease on the death certificate. Predictor variables used as biomarkers for the risk of death from COVID-19 were gender, age of the participants over forty years, having a positive RT-PCR result, suffering from any CD, as well as the number of them. Patients who died were compared with living. The population of deceased and alive patients in both categories of interest were extracted from the database with the daily reports of the epidemiology service of the General Hospital Pachuca. The behavior of the biosociodemographic variables were studied, performing a univariate analysis. In this, the prevalence of exposure of the variables of interest were calculated. The crude odds ratio was estimated to evaluate the association between study factors and death secondary to COVID-19 with 95% confidence intervals according to the design used by [31] and [32]. From the quantitative variables, Student's t-test was calculated; the comparative means were between the patients who died and those who were alive. A trend analysis was calculated, using a trend Chi-square test, to observe the behavior of the odds in each decade of the participants' lives and identify whether the trend of the calculated odds was significant [33]. For multivariate analysis, unconditional logistic regression models and adjusted in order to estimate the odds ratio [34]. All statistical analysis was calculated with 95% significance using the software for statistics and data Stata® 15.0. In the selection of variables, those that explained death from COVID-19 were used. The risk of dying from COVID-19 was estimated in male patients, those who were 40 years of age and older, those who had a positive RT-PCR test, as well as those who had chronic degenerative diseases and were calculated the risk for each of them separately. From the original variables, new ones were created, for example, age was categorized in patients under 40 years of age, from 40 to 49, 50 to 59 years, 60 and over. Another dichotomous variable classified participant under 40 and 40 and over. Of the patients who in the report stated having some CD and the name of these pathologies, a new dichotomous variable was created where it will be identified whether or not they had an CD, in the same way in case of having CD, another was created identifying how many CD had every patient. Dichotomous variables were created for the patients who had a certain DM, SAH, obesity, CKD, Chronic Obstructive Pulmonary Disease (COPD), comparing them with the patients who stated that they did not have any CD.

III. RESULTS

The information to be analyzed was extracted from an electronic database created since the daily reports of patients who were attended at the hospital with a laboratory-confirmed or clinical positive diagnostic of COVID-19, with data from March 2020 to March 2021, the file contained evidence on 4,418 people who were treated at the Pachuca General Hospital, who had requested attention for presenting respiratory infection during the time of the research.

According to the data, 14.64% of people died during that period of time. From the total population studied, 50.97% of the population were men, of which 18.92% died, while mortality in women was 10.22% ($P < 0.05$). For the laboratory test, 62.15% of the population had a positive RT-PCR and patients who died, 83.31% of them were positive to it ($P < 0.05$). On the other hand, the influence of each of the CD presented a different behavior between the patients who died or survived. 30.85% of all participants had at least one comorbidity, but among the patients who died, 62.13% had at least one comorbidity. The three more frequent CD were DM, SAH, and obesity. As of the total number of participants, 69.15% stated that they did not have any CD, 19.53% had one, 8.96% had two, 2.11% had three, and 0.25, which corresponds to 11 patients, had four CD. 12.97% of the population had DM; 6.32% were hypertensive, 5.23% had some degree of obesity; 0.63 and 0.54% patients had CKD and chronic obstructive pulmonary disease respectively, these pathologies were related to the death of the participants as it is shown in Table I.

TABLE I: COMPARISON OF THE STUDY POPULATION BETWEEN PATIENTS WHO DIED AND SURVIVED DUE TO COVID-19

Variable	Deceased	Survived	Total	P-value
Sex				
Male	18.92	81.08	50.97	0.000*
Female	10.20	89.80	49.03	
RT-PCR				
Positive	83.31	58.53	37.85	0.000*
Negative	16.69	41.47	62.15	
Comorbidity				
Yes	62.13	25.48	30.85	0.000*
No	37.87	74.52	69.15	
Categorized age				
Less than 40 years	9.27	49.59	43.68	0.000*
40 to 49 years	17.16	20.29	19.83	
50 to 59 years	22.87	15.30	16.41	
60 and over	50.70	14.82	20.08	
Number of CD				
Without CD	37.87	74.52	69.15	0.000**
A CD	33.85	17.08	19.53	
Two CD	22.26	6.68	8.96	
Three CD	5.41	1.54	2.11	
Four CD	0.62	0.19	0.25	
DM				
Yes	46.97	11.24	15.79	0.000*
No	53.03	88.76	84.21	
SAH				
Yes	27.73	6.18	8.37	0.000*
No	72.27	93.82	91.63	
Obesity				
Yes	16.38	6.11	7.03	0.000*
No	83.62	93.89	92.97	
CKD				
Yes	3.16	0.71	0.91	0.000*
No	96.84	99.29	99.09	
COPD				
Yes	4.67	0.43	0.78	0.000*
No	95.33	99.57	99.22	

Chi square test *

Fisher's exact test**

A higher risk for dying was found in male patients compared to women (OR= 2.05, 95% CI 1.71-2.45; $P < 0.05$). Other variables were also found associated with the increased dying risk, such as the age over 40 years old, having a positive RT-PCR result and having at least one CD, the results of the

crude and adjusted odds ratio are shown in Table II.

TABLE II: RISK OF DYING FROM COVID-19, CRUDE ODDS RATIO AND ADJUSTED FOR CERTAIN STUDY VARIABLES

Variable	Deceased	Crude Odds Ratio	CI 95%	Adjusted Odds Ratio **	CI 95%
Sex					
Male	426	2.05	1.7-2.4	1.8	1.5-2.1
Female	221	1.0			
Age					
Patients aged 40 and over	587	9.6	7.3-12.8	6.4	4.8-8.5
Less than 40 years	60	1.0			
RT-PCR					
Positive	539	3.5	2.8-4.4	2.3	1.8-2.9
Negative	108	1.0			
DM					
Yes	217	4.8	3.9-5.8	3.9	3.1-4.9
No	430	1.0			
SAH					
Yes	94	3.2	2.5-4.2	3.3	2.5-4.5
No	553	1.0			
Obesity					
Yes	48	1.5	1.1-2.1	2.5	1.7-3.6
No	599	1.0			
CKD					
Yes	8	2.3	1.02-5.3	7.9	2.1-21.5
No	639	1.0			
COPD					
Yes	12	5.9	2.6-13.2	7.8	3.2-18.9
No	635	1.0			
CD					
With	402	4.7	4.01-5.7	3.3	2.7-4.0
Without	245	1.0			

** Adjusted for the model's own variables

The average age of the total of patients was 44.22 ± 16.85 years; the mean age of those who died was 59.12 ± 14.42 , compared to those who lived with an average of 41.67 ± 15.89 ; with a $P < 0.05$, other differences of the quantitative variables of the study are shown in Table III.

TABLE III: COMPARISON OF MEANS OF THE STUDY VARIABLES

Variable	n	Median	S.D.	CI 95%	P-value *
Age					
Deceased	647	59.12	14.42	58.01-60.23	0.000
Surviving	3771	41.67	15.89	41.16-42.17	
Number of CD					
Deceased	402	1.56	0.69	1.49-1.63	0.000
Surviving	961	1.40	0.63	1.36-1.44	
Days of onset of symptoms and collection of the RT-PCR sample					
Deceased	647	4.97	2.96	4.7-5.20	0.000
Surviving	3771	3.82	2.55	3.73-3.90	
Days of symptom onset and delivery of RT-PCR results					
Deceased	647	6.19	3.80	5.89-6.48	0.000
Surviving	3771	5.60	2.95	5.51-5.69	
Days of sample collection and delivery of RT-PCR result					
Deceased	647	2.36	2.97	2.13-2.59	0.0014
Surviving	3771	2.08	1.84	2.02-2.14	

* T de Student

Age, in this research, had an influence on the risk of dying, since there is an increase in the risk of dying for each year of age, the risk of dying had an OR of 1.06 95% CI 1.061-1.073; $P < 0.05$, according to a logistic regression model. In the same way, trend analysis showed that there was a rise in the odds

for demise for each decade of age of the participants, this trend increases as the individuals belong to a greater decade of age, the trend found had a significant result as observed in Table IV.

TABLE IV: COMPARISON OF THE ODDS OF DEATH FROM COVID-19 BY DECADES OF AGE USING TREND ANALYSIS

Decades	Deceased	Survived	Odds ** †	CI 95%
0-9	0	33	0.000	-
10-19	2	136	0.014	0.003-0.059
20-29	11	803	0.013	0.007-0.024
30-39	47	898	0.052	0.039-0.070
40-49	111	765	0.145	0.118-0.177
50-59	148	577	0.256	0.214-0.307
60-69	169	357	0.473	0.394-0.568
70-79	107	143	0.748	0.582-0.961
80-89	45	9	0.918	0.612-1.376
90-99	7	10	0.700	0.266-1.838
Total	647	3,771	---	---

** It is the ratio of an unfavorable event between a favorable event

† Chi-square test of trend of odds $P < 0.05$

IV. CONCLUSION

According to data from the international literature and those obtained in this study, it can be concluded that men have a higher mortality risk than women. The presence of CD in patients with COVID-19 is a predictor of a poor prognosis for people suffering from this type of disease, increasing the probability of dying, besides the more diseases they suffer the higher the risk of mortality. Diabetes mellitus and obesity are among the most frequent CDs related to death from COVID-19 in this study, along with the fact they are very common in Mexican population. These conditions alone promote inflammatory processes in people and might exacerbate this response in subjects infected with SARS-CoV 2, giving rise to the cytokine storm which aggravates the state of health of people. However, in a separate analysis of the CD, not all have the same behavior, since the one with the highest risk of dying in this study was calculated for Chronic Obstructive Pulmonary Disease (COPD), this can be understood if we consider a pre-existing damage to the lung tissue plus the pneumonia related to COVID-19 infection. Regarding to aging, it was found that as the age of the participants increased, there was a greater probability of dying, being more evident after the age of 50, and rising the risk with every decade of life. Our study points out after the 5th decade of life the probability of dying increases, regardless of sex and suffering from any CD, perhaps the depletory effect of aging decline the immune response capacity against the virus becoming more dangerous in patients with advancing age. More research is needed to clarify the effect of age and the other associated factors mentioned in this paper to determine their influence on mortality from COVID-19.

CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

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