Risk factors for death by COVID-19, public hospital in Ciudad Juárez, México

Factores de riesgo para defunción por COVID-19 en un hospital público en Ciudad Juárez, México

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Abstract

Background: On March 11, 2020, a COVID-19 pandemic was declared for a novel coronavirus named SARS-CoV-2 virus. This virus induces a severe inflammatory response, producing death in patients with COVID-19 disease, in México, in 2021, COVID-19 mortality becomes the second cause of death, with higher mortality on persons with previous conditions like chronic non-communicable diseases.

Objective: To identify the risk factors associated with deaths in patients with diagnosed COVID-19 from January 1 to December 31, 2021, hospitalized in a clinic of IMSS in Ciudad Juárez, Chihuahua, México.

Material and methods: An observational, cross-sectional, analytical study was used. Information from patients with confirmed diagnostic of COVID-19 was collected from the SINOLAVE platform and medical records. To identify risk factors, univariate and multivariate logistic regression was used.

Results: A total of 277 patients were included, 51.62% were male, the rest were female. Death from COVID-19 were associated with age (OR: 1.03; 95%CI: 1.01 - 1.06, $p \leq 0.001$), chronic kidney disease (OR: 3.20; 95%CI: 1.58 - 6.48, $p \leq 0.001$) chronic neurological diseases (OR: 5.27; 95%CI: 1.30 - 20.03, $p \leq 0.05$), and chronic obstructive pulmonary diseases (OR: 12.24; 95%CI: 1.44 - 103.82, $p \leq 0.05$); the proportion of death by sex were similar in the study

Conclusion: Age, chronic kidney disease, chronic neurological disease, and chronic obstructive pulmonary diseases were associated with death in patients with COVID-19. It's important to prevent and control chronic non-communicable diseases; the distribution was similar in both sexes.

Resumen

Introducción: el 11 de marzo del 2020, se declaró pandemia por el nuevo coronavirus llamado SARS-CoV-2. Este virus generó una respuesta inflamatoria severa, produciendo muertes en pacientes con la enfermedad de COVID-19. En el 2021, en México, la enfermedad por COVID-19 fue la segunda causa de muerte, presentándose una mayor mortalidad en pacientes con factores de riesgo como enfermedades crónicas no transmisibles.

Objetivo: identificar los factores de riesgo asociados a defunción en pacientes con diagnóstico confirmado a COVID-19 del 1 de enero al 31 de diciembre del 2021, hospitalizados en una clínica del IMSS en Ciudad Juárez, Chihuahua, México.

Material y métodos: se realizó un estudio observacional, transversal, analítico. Se recolectó información de los pacientes con diagnostico confirmado a COVID-19, por medio de la plataforma SINOLAVE y registros médicos. Para identificar los factores de riesgo, se utilizó regresión logística uni y multivariada.

Resultados: un total de 277 pacientes reunieron los criterios de selección, el 51.62% fue del sexo masculino y el resto sexo femenino. La defunción por COVID-19 se asoció con la edad (OR: 1.03; IC95%: 1.01 - 1.06, $p \leq 0.001$), enfermedad renal crónica (OR: 3.20; IC95%: 1.58 – 6.48, $p \leq 0.001$), enfermedades neurológicas (OR: 5.27: IC95%: 1.30 - 20.03, $p \leq 0.05$), enfermedad pulmonar obstructiva crónica (OR: 12.24; IC95%: 1.44 -103.82, $p \leq 0.05$); la proporción de defunción por sexo fue similar.

Conclusión: la defunción por COVID-19 en pacientes confirmados se asoció con la edad, enfermedad renal crónica, enfermedades neurológicas, enfermedad pulmonar obstructiva crónica; con una distribución por defunción similar para ambos sexos.

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Introduction

On December 31, 2019, the World Health Organization (WHO) reported an outbreak of pneumonia cases in Wuhan, China.[1] The agent was a new coronavirus named Severe Acute Respiratory Syndrome Coronavirus type 2 (SARS-COV-2) responsible of the coronavirus disease 2019 (COVID-19).[2] On March 11, 2020, the WHO declared the COVID-19 disease a public heath pandemic.[3]

A high incidence and transmissibility of the virus was observed, especially on patients with comorbidities.[4] Most of the infected people presented from mild to moderate respiratory illness; and close to 10% were seriously ill and die. People with previous diagnosis of a noncommunicable disease (NCD), such as, cardiovascular disease, diabetes, chronic respiratory disease, and or cancer, were in higher risk of death.[5] The SARS-CoV-2 virus induces a severe inflammatory response, causing a higher mortality in infected older adults.[6]

In 2021, COVID-19 was the second cause of death in México, with a higher mortality in patients with previous diagnosed condition.[7]

Documented risk factors associated with death in patients affected by COVID-19 in different countries like Mexico and Iran were age, hypertension (78.9%), diabetes (44.9%), cardiovascular disease (24.5%), and other identified factors were COPD, obesity, and smoking.[7,8]

Hypertension is the risk factor associated with infection and with severity of COVID-19 disease,[9] this risk is associated with an increase of angiotensin-converting enzyme 2 (ACE2) receptors in the cells, facilitating the entrance of the virus to the cells.[10]

The proportion of patients with diabetes and COVID-19 disease varies, with a prevalence between 36 to 58%, from a mild COVID-19 disease to severe disease, and progress to death.[11] In patients with diabetes their immune system is altered, and with the infection with COVID-19 the endothelial dysfunction increases, responding to an amplified systemic inflammatory responses.[12]

Infection of COVID-19 elevates biomarkers that indicate cardiac injury. In hospitalized patients 36% presented elevate levels of serum troponin, cardiac troponin, NT-proBNP and D-dimer increasing the risk for death from COVID-19, and even more in patients with previous cardiac disease (CVD).[13]

The association of asthma with COVID-19 morbidity and mortality is not clear, this association of patients with asthma and COVID-19 is mostly related to the activities from pre-vention of infection with the infection with the virus and with the treatment establish for asthma.[14,15]

Patients with Chronic Kidney Disease (CKD) have more risk for coagulopathies like thrombosis and hemorrhage;[16] the inflammatory response of COVID-19 causes endothelial dysfunction increasing the risk for coagulopathies, hospitalized and death in these patients.[17]

The association between obesity and COVID-19 severity had been documented in many countries, including Mexico. In México, obesity is the third morbidity risk factor in patients with COVID-19.[18] It is known that people with obesity have an abnormal secretion of cytokines related to the grade of inflammation characteristic of abdominal obesity, these persons have altered immune response, and this could be the reason of the association of obesity and COVID-19 morbidity.[19]

Chronic neurological disease is mentioned as a possible risk factor for COVID-19, some authors recommend studying this possible risk factor.[20] Patients with chronic neurological disease have a chronic inflammatory process and increase with SARS-CoV-2 virus.[21]

Patients with chronic obstructive pulmonary diseases (COPD) have ACE2 receptor increased in epithelial cells and this increase is proportional with body mass index.[22]

Smoking is a well-known risk factor for COVID-19; studies showed an association with upregulation in the lung of the ACE-2 receptor for the entrance of virus and an increased ACE-2 expression increasing susceptibility and mortality.[23]

COVID-19 is highly transmissible, highly prevalent, deaths, and it is likely to become endemic. Therefore, we must continue to study it to understand its impact on the population's health, and be prepared, as well as to address the main risk factors associated with death from COVID-19.

The objective of the study was to identify common risk factors associated with mortality in patients hospitalized with confirmed diagnostic of COVID-19.

Methods

An observational, cross-sectional, analytical study was conducted on patients hospitalized with confirmed diagnostic of COVID-19 from January 1 to December 31, 2021, on Hospital General de Zona (HGZ) No. 6 IMSS in Ciudad Juárez, Chihuahua, México. Previous data collection, the approval of the Ethics Committee of the Mexican Institute of Social Security (IMSS) was obtained.

Hypertension, diabetes obesity, CKD, CVD, chronic neurological disease, and COPD were previously diagnosed in the medical records.

The study included patients from both sexes, ≥ 18 years of age. Outpatients and non-affiliated in the IMSS were excluded. The confirmation of COVID-19 infection was by PCR-RT (43%) and rapid antigen test for COVID-19 (25%) and the rest with both tests (32%).

The sampling was using the intentional non-probability method. The patient's information was collected from the online notification system for epidemiological surveillance (SINOLAVE) and medical records. The data obtained was captured in a specific format developed on Microsoft® Excel® (version 2304); for the statistical analysis the statistical package StataCorp. 2015. Stata Statistical Software: Release 14. College Station, Tx: StataCorp LP. was used. The Kolmogorov-Smirnov normality test was used with a p-value ≥ 0.05, and skewness was evaluated. A possible association between COVID-19 and death was considered with p-value ≤ 0.05; univariate and multivariate forward stepwise logistic regression were used to identify possible risk factors. The results are presented in tables with frequency (n), percentage, mean and standard deviation (SD), in quantitative variables and percentages in qualitative. Odds Ratio (OR) values are presented including p-value ≤ 0.05 and 95% confidence intervals. Death was the dependent variable and risk factors were the independent variables. It is important to mention that the study has the approval of the IMSS ethics committee, CONBIOÉTICA 08 CEI 003 2018072.

Results

The study included two hundred and seventy-seven patients with confirmed diagnosis of COVID-19 in the Hos-

pital General de Zona (HGZ) No. 6. The mean age of the patients was 61.62 years (SD: 13.04) years, the age group most represented was 60-69 years in both sexes (31%) (table I).

The most common preconditions were hypertension (67.50%), diabetes mellitus (53.78%) and obesity (31.40%). Other conditions on both sexes were chronic kidney diseases (CKD) and cardiovascular conditions (table II).

From the 277 hospitalized patients with confirmed diagnostic of COVID-19, 128 died (46.21%); the mean of age of deceased patients was 64.92 years (SD: 12.78); 48.7% were male and more than fifty percent were ≥60-year-old. No statistical difference on age between males and females was observed. The principal risk factor for death was hypertension (70.31%), follow by diabetes (56.25%) and obesity (32.81%) in both sexes. When risk factors in death patients are analyzed by sex, male had little more hypertension that females (72.31% vs. 68.25%); diabetes, obesity and cardiovascular diseases were more prevalent on female patients (63.49% vs. 49.23%; 38.09% vs. 27.69%; and 19.04% vs. 7.69%, respectively); CKD was reported in around a quart of the patients from both sexes and more males had diagnosis of chronic neurological diseases. Smoking and COPD affected less than 10% of deceased patients from both sexes (table III).

The results in univariate logistic regression show an association of death with age (OR: 1.03; 95%CI: 1.01 - 1.05, $p \leq 0.001$) with an increase on risk from OR 2.10 in patients with 50-year-old to OR 5.33 in the 80-year-old group. Other risk factors were CKD (OR: 2.95; 95%CI: 1.48 - 5.85, $p \leq 0.05$); chronic neurological diseases (OR: 3.07; 95% CI: 0.93 - 10.04, $p \leq 0.05$) and COPD (OR: 11.19; 95% CI: 1.39 - 89.59, $p \leq 0.05$), hypertension, diabetes, obesity, CVD, chronic neurological and smoking, were no confirmed as factors for death in these patients.

Table I General characteristics of hospitalized patients with COVID-19 by sex in HGZ No. 6, Ciudad Juarez, 2021

Characteristics	Male	Female	Total	p
	n (%)	n (%)	n (%)	
Sex (%)	143 (51.62)	134 (48.38)	277 (100)	NA
Age (years) (mean ±SD)	60.73 (13.25)	62.56 (12.79)	61.62 (±13.04)	0.243
Age group (%)				
≤ 39	6 (2.17)	5 (1.80)	11 (3.97)	
40-49	22 (7.94)	16 (5.78)	38 (13.72)	-
50-59	37 (13.35)	31 (11.20)	68 (24.55)	-
60-69	43 (15.52)	44 (15.89)	87 (31.41)	-
70-79	22 (7.94)	24 (8.66)	46 (16.60)	-
≥ 80	13 (4.70)	14 (5.05)	27 (9.75)	

Source: Sistema para la Notificación en línea para la Vigilancia Epidemiológica (SINOLAVE) and medical files
HZG: Hospital General de Zona No. 6; SD: Standard deviation; p: Statistical significance; NA: Not applicable

Table II Risk factors of hospitalized patients with COVID-19 by sex in HGZ No. 6, Ciudad Juarez, 2021 (*n* = 277)

Risk Factors	Male (*n* = 143)		Female (*n* = 134)		Total		*p*
	n	(%)	*n*	(%)	*n*	(%)	
Hypertension	96	(34.65)	91	(32.85)	187	(67.50)	0.890
Diabetes Mellitus	69	(24.90)	80	(28.88)	149	(53.78)	0.056
Obesity	35	(12.63)	52	(18.77)	87	(31.40)	0.010
CKD	23	(8.30)	21	(7.58)	44	(15.88)	0.925
Cardiovascular	12	(4.33)	26	(9.38)	38	(13.71)	0.008
Smoking	11	(3.97)	8	(2.88)	19	(6.85)	0.571
CND	6	(2.16)	8	(2.88)	14	(5.04)	0.501
Asthma	1	(0.36)	11	(3.97)	12	(4.33)	0.002
COPD	6	(2.16)	4	(1.44)	10	(3.60)	0.589

Source: Sistema para la Notificación en línea para la Vigilancia Epidemiológica (SINOLAVE) and medical files
HZG: Hospital General de Zona No. 6; *p*: Statistical significance; CKD: Chronic Kidney Disease; CND: Chronic Neurological Diseases; COPD: Chronic Obstructive Pulmonary Disease

After multivariate regression a $p \leq 0.001$ was obtained, the intercept of the model was -0.8267 and 0.0794 pseudo R2 was obtained, death was associated with age (OR: 1.03; 95%CI: 1.01 - 1.06, $p \leq 0.001$); CKD (OR: 3.20; 95%CI: 1.58 - 6.48, $p \leq 0.001$); chronic neurological diseases (OR: 5.27; 95%CI: 1.30 - 20.03, $p \leq 0.05$); and COPD (OR: 12.24; 95%CI: 1.44 - 103.82, $p \leq 0.05$) (table IV).

Discussion

The results obtained in this study show that population in Ciudad Juarez are most affected with COVID-19 and hospitalized when they were in the 60- to 69-years-old age group (31%); the age group with the higher risk for severe illness, hospitalization and death in this study was similar to the reported in other studies, showing us that despite the differences between different cultures, geographic areas and lifestyles, age continuous to be an important and non-modifiable risk factor for certain types of diseases, such as COVID-19.[24,25]

This study found hypertension (68%), diabetes mellitus (53.8%) and obesity (31%) are the most common risk factors for COVID-19 disease, similar to risk factors mentioned in the literature; lifestyle and adherence to medical treatments continues being a way to achieve better control of the disease.[26,27]

The mortality in the study was 46%, a higher mortality compared with the 37.9% of 663 patients and 38.4% of 137 patients reported in two study in Wuhan, China; the popu-

Table III Risk factors in dead patients by sex in patients hospitalized with COVID-19 in HGZ No, 6, Ciudad Juarez, 2021

Characteristic	Female (*n* = 63) *n* (%)		Male (*n* = 65) *n* (%)		Total (*n* =128) *n* (%)		*p*
Sex (%)	63	(49.22)	65	(50.78)	128	(100)	
Age (years) Mean (SD)	64.82	(12.37)	65.03	(12.91)	64.92	(12.60)	0.927
Hypertension (%)	43	(68.25)	47	(72.31)	90	(70.31)	0.616
Diabetes (%)	40	(63.49)	32	(49.23)	72	(56.25)	0.749
Obesity (%)	24	(38.09)	18	(27.69)	42	(32.81)	0.210
CKD (%)	14	(22.22)	16	(24.6)	30	(23.43)	0.749
Cardiovascular (%)	12	(19.04)	5	(7.69)	17	(13.28)	0.058
Smoking habit (%)	5	(7.93)	4	(6.15)	9	(7.03)	0.693
CND (%)	6	(9.52)	4	(6.15)	10	(7.81)	0.478
COPD (%)	4	(6.34)	5	(7.69)	9	(7.03)	0.766

HZG: Hospital General de Zona No. 6; SD: Standard deviation; *p:* Statistical significance; CKD: Chronic Kidney Disease; CND: Chronic neurological diseases; COPD: Chronic Obstructive Pulmonary Disease; Based on X^2. Based on *t* test

Table IV Multivariate logistic regression, risk factors for death by sex patients hospitalized COVID-19 HGZ No. 6, Ciudad Juarez, 2021

Risk factor	OR	95%CI	*p*	βi
Age	1.03	1.01 - 1.06	0.001	0.6351
CKD	3.20	1.58 - 6.48	0.001	1.16
CND	5.27	1.30 - 20.03	0.025	1.19
COPD	12.24	1.44 - 103.82	0.022	2.31

HZG: Hospital General de Zona No. 6; OR: Odds ratio; CI: Confidence Interval; *p*: Statistical Significance; β_i: Logistic Regression Coefficient; CKD: Chronic Kidney Disease; CND: Chronic Neurological Diseases; COPD: Chronic Obstructive Pulmonary Disease

lation of Wuhan, China had a lower prevalence of NCD compared with the participants in this study, and primary prevention is one of the pillars that must be strengthened.[25]

From the hospitalized patients with confirmed COVID-19, 57.76% were ≥ 60 years old and 48.75% were male; most of the deaths occurred in the 60 to 69 years of age, similar age to other studies. The proportion of death by sex were similar in the study as well in the literature, without showing a significant difference, sex is not a risk factor in this study.[28,29]

We confirmed the risk of death with age (OR: 1.03; 95%CI: 1.01 -1.06 $p \leq 0.001$),[20] CKD (OR: 3.20; 95%CI: 1.58 - 6.48, $p \leq 0.001$),[29] chronic neurological diseases (OR: 5.27; 95%CI: 1.30 - 20.03, $p \leq 0.05$),[20] and COPD (OR: 12.24; 95%CI: 1.44 - 103.82, $p \leq 0.05$).[22]

Conclusion

In the population of Ciudad Juarez, Mexico, age, chronic kidney disease, chronic neurological disease, and COPD are associated with death in patients with COVID-19; the distribution was similar in both sexes. COVID-19 disease has a high transmissibility, high incidence, and become an endemic disease; it is important to decrease death in high susceptible population as are the older adults with strategies of prevention and strengthening through exercise and diet.

This study has the limitation that only patients from one public governmental hospital were included, and the data used for analysis was taken from the online notification system for epidemiological surveillance (SINOLAVE) and compete with information from the medical records of patients with previous diagnosis for COVID-19. It was not possible to confirm the previous diagnosis of the selected risk factors.

The strengths of the study include that this is one of the few studies done in the state and in the country, identifying risk factor for death in a very specific population with confirmed diagnosis of COVID-19.

This study has been approved by the ethics committee of the IMSS and the UACJ, the use of the data was taken care of.

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