FACTORS ASSOCIATED WITH INFECTION IN GROUPS WITH CLINICAL RISK CONDITIONS FOR COMPLICATIONS FROM COVID-19

FATORES ASSOCIADOS À INFECÇÃO EM GRUPOS COM CONDIÇÕES CLÍNICAS DE RISCO PARA COMPLICAÇÕES POR COVID-19

FACTORES ASOCIADOS A INFECCIÓN EN GRUPOS CON CONDICIONES CLÍNICAS DE RIESGO DE COMPLICACIONES POR COVID-19

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ABSTRACT

Objective: to analyze the risk factors associated with COVID-19 infection in groups with clinical risk conditions for the development of complications from the disease. **Method:** this is a retrospective census study with data from rapid tests for COVID-19 carried out in Fast Track Basic Health Units in Teresina-Piauí, between April 26 and July 15, 2020. Information from 16,449 individuals was analyzed through a standard form and, in case of a positive test, also notification forms for influenza syndrome suspected of having a disease caused by the coronavirus 2019 we analyzed. For statistical analysis, the Statistical Package for Social Science, version 22.0, was used. The study was approved by the Research Ethics Committee of the Universidade Federal do Piauí. **Results:** 22.30% of those investigated had some risk factor for the development of complications by COVID-19. There was a statistically significant association between the test result for COVID-19 and cardiac risk factor (p=0.020), diabetes *Mellitus* (p=0.000), arterial hypertension (p=0.000), smoking (p=0.013), and dyslipidemia (p=0.028). As for the approach adopted because of the positive results for COVID-19, an association was detected with the variables risk factor (p=0.000), cardiac risk factor (p=0.000), diabetes *Mellitus* (p=0.000), and obesity (p =0.003). Possessing a risk factor, heart problem, diabetes, or obesity was associated with the severity of COVID-19, represented by the conduct of referral to the emergency department. **Conclusion:** the study provides a comprehensive reference of information in response to the COVID-19 pandemic in the capital of Piauí. It is believed that it will support the development of control actions, especially among those at risk for complications from the disease.

Keywords: Coronavirus Infections; Risk Factors; Pandemics.

RESUMO

Objetivo: analisar fatores de risco associados à infecção por COVID-19 em grupos com condições clínicas de risco para desenvolvimento de complicações pela doença. **Método:** estudo censitário, retrospectivo, com dados oriundos de testagens rápidas para COVID-19 realizadas em unidades básicas de saúde Fast Track de Teresina-Piauí, entre 26 de abril e 15 de julho de 2020. Analisaram-se informações de 16.449 indivíduos por meio de formulário padrão e, em caso de testagem positiva, também das fichas de notificação de síndrome gripal suspeito de doença pelo coronavírus 2019. Para análise estatística, utilizou-se o Statistical Package for the Social Science, versão 22.0. O estudo foi aprovado pelo Comitê de Ética em Pesquisa da Universidade Federal do Piauí. **Resultados:** 22,30% dos investigados apresentavam algum fator de risco para desenvolvimento de complicações pela COVID-19. Verificou-se associação estatisticamente significativa entre resultado do teste para COVID-19 e fator de risco cardíaco (p=0,020), diabetes Mellitus (p=0,000), hipertensão arterial (p=0,000), tabagismo (p=0,013) e dislipidemia (p=0,028). Quanto à conduta adotada diante dos resultados positivos para COVID-19, detectou-se associação com as variáveis fator de risco (p=0,000), fator de risco cardíaco (p=0,000), diabetes Mellitus (p=0,000) e obesidade (p=0,003). Possuir fator de risco, problema cardíaco, diabetes ou obesidade apresentou relação com a gravidade da COVID-19, representada pela conduta de encaminhamento ao serviço de urgência. **Conclusão:** o estudo fornece quadro abrangente de informações em resposta à pandemia de COVID-19 na capital do Piauí. Acredita-se que subsidiará o desenvolvimento de ações de controle, especialmente entre aqueles com condições de risco para complicações pela doença.

Palavras-chave: Infecções por Coronavírus; Fatores de Risco; Pandemias.

RESUMEN

Objetivo: analizar los factores de riesgo asociados a la infección por COVID-19 en grupos con condiciones clínicas de riesgo de desarrollar complicaciones de la enfermedad. **Método:** estudio censitario retrospectivo con datos de pruebas rápidas para COVID-19 realizadas en Unidades Básicas de Salud Fast Track en Teresina-Piauí, entre el 26 de abril y el 15 de julio de 2020. Se analizó información de 16.449 personas a través de un formulario estándar y, en caso de una prueba positiva, también formularios de notificación para el síndrome gripal sospechoso de tener una enfermedad causada por el coronavirus 2019. Para el análisis estadístico se utilizó el Statistical Package for the Social Science, versión 22.0. El estudio fue aprobado por el Comité de Ética en Investigación de la Universidad Federal do Piauí. **Resultados:** 22,30% de los investigados presentaba algún factor de riesgo para el desarrollo de complicaciones por COVID-19. Hubo una asociación estadísticamente significativa entre el resultado de la prueba para COVID-19 y el factor de riesgo cardíaco (p = 0,020), diabetes Mellitus (p = 0,000), hipertensión arterial (p = 0,000), tabaquismo (p = 0,013) y dislipidemia (p = 0,028).

*En cuanto al abordaje adoptado ante los resultados positivos para COVID-19, se detectó asociación con las variables factor de riesgo (p = 0,000), factor de riesgo cardíaco (p = 0,000), diabetes Mellitus (p = 0,000) y obesidad (p = 0,003). Poseer un factor de riesgo, problema cardíaco, diabetes u obesidad se asoció con la gravedad del COVID-19, representado por la conducta de derivación al servicio de urgencias. **Conclusión:** el estudio proporciona un marco de información integral en respuesta a la pandemia de COVID-19 en la capital de Piauí. Se cree que apoyará el desarrollo de acciones de control, especialmente entre aquellos en riesgo de complicaciones por la enfermedad.*

Palabras clave: *Infecciones por Coronavirus; Factores de Riesgo; Pandemias.*

INTRODUCTION

COVID-19 is a disease caused by the SARS-CoV-2 virus and has a clinical spectrum that ranges from asymptomatic infections to severe conditions.[1] According to the World Health Organization (WHO), approximately 80% of patients with COVID-19 can be asymptomatic or oligosymptomatic, and approximately 20% of the detected cases require hospital care due to respiratory difficulties. About 5% of these patients may need ventilatory support.[2]

The SARS-CoV-2 virus is spread from person to person through droplets of saliva or nasal secretions when an infected person coughs or sneezes. In symptomatic cases, it has an acute respiratory syndrome and can be confused with several other common diseases.[1]

The clinical conditions and risk factors for the development of complications by COVID-19 are: people aged 60 years or more; with severe or decompensated heart disease; with severe or decompensated lung disease; smokers; immunocompromised; advanced-stage chronic kidney patients; diabetics; obese; hypertensive; individuals with chromosomal diseases with a state of immunological weakness; people with malignant neoplasms; pregnant women1 and postpartum women.[3]

Until March 30, 2021, Piauí had 203,458 confirmed cases and 4,066 deaths, with 73,028 confirmed and 1,574 deaths from the capital. Among the deaths, 77.75% were over 60 years old, 46.97% were cardiac, 24.62% were diabetic, 4.75% were lung disease and 3.66% were obese.[4]

In this context, and considering that operational definitions must be contextualized regionally, knowledge of the serological status of groups with clinical conditions at risk for the development of complications from COVID-19 and its associated factors have the potential to guide public policies in the context of health care and the control of social mobility, in addition to being an important tool to reduce transmission and prevent its spread.[2]

Given this context, this research aims to analyze risk factors associated with COVID-19 infection in groups with clinical conditions at risk for developing complications from the disease.

METHOD

This is a census and retrospective study. The data collected are related to rapid tests for COVID-19 of people with clinical conditions at risk for developing complications from COVID-19, carried out by the Basic Health Units (UBS) Fast Track (exclusive care for patients with flu syndrome) from Teresina-Piauí, from April 26 to July 15, 2020.

We included data from 16,449 individuals registered in the e-SUS system in the city of Teresina-Piauí, who had been tested for COVID-19, who had clinical conditions of risk for developing complications from COVID-19, attended at one of the 26 UBS Fast Track and with the result available until July 15, 2020. We excluded tests that had been carried out at home, in long-term care facilities, in commercial establishments, or tracking and testing centers, as well as tests on individuals under 18 years old.

Data were collected through access to the spreadsheet generated from an electronic form (Google Forms), prepared by the Municipal Health Foundation (*Fundação Municipal de Saúde* - FMS) of Teresina-Piauí. We obtained the information of interest from a structured questionnaire, prepared by the FMS, which was completed at the time of the exam. In cases of positive testing, we also considered the information contained in the notification forms for influenza illness suspected by the coronavirus 2019 - COVID-19 (CID B34.2). The pairing of information was done based on the record number of the Unified Health System (*Sistema Único de Saúde* - SUS).

Sociodemographic and clinical-epidemiological characteristics were considered for this study, which includes: symptoms (sore throat, dyspnea, myalgia/arthralgia, fever, cough, nausea/vomiting, headache, diarrhea, runny nose, sputum production, weakness, and O_2 saturation <95%) and patient-reported information on morbidity (decompensated chronic respiratory diseases, chronic heart disease, diabetes *Mellitus*, advanced-stage chronic kidney disease - grades 3, 4 and 5 -, immunosuppression, high-risk pregnancy, chromosomal diseases or status of immunological weakness and obesity).

Serological status was verified through a rapid test, in which each participant underwent collection of a drop of capillary blood by digital puncture, under the precautionary/biosafety recommendations of the National Health Surveillance Agency (*Agência Nacional de Vigilância Sanitária* - ANVISA).5 This test aims to detect specific antibodies, IgG and IgM, produced by the human body against the SARS-CoV-2 virus or detect specific antigens of this virus.[1]

The data survey took place in August 2020 and was carried out by undergraduate students in Nursing and the Professional Postgraduate Program in Family Health (UFPI/RENASF/FIOCRUZ), at the Health Information Management of Primary Care at FMS, at previously scheduled times and days.

We coded the data obtained for the elaboration of a specific database for the study. Then, we exported and submitted them to statistical processing in the Statistical Package for Social Science (SPSS) software, version 22.0. Descriptive statistics were performed such as measures of central tendency (simple frequency and mean) and measure of dispersion (standard deviation).

The Kolmogorov-Smirnov test was used to verify the assumption of normality, and we found a non-normal distribution pattern. To verify the association between qualitative variables, we used the chi-square test. When the frequency of the cells was less than 20% or five, Fischer's exact test was performed. The strength of associations between variables was measured by the odds ratio (OR) and confidence intervals (95% CI). For all analyses, a significance level of 0.05 was adopted. Thus, the results that presented $p \leq 0.05$ or when the confidence intervals did not pass the value of 1.0 were considered statistically significant.

The study was approved by the Research Ethics Committee (CEP) of the Universidade Federal do Piauí (UFPI) via Plataforma Brasil, through Opinion nº. 4,204,274. The principles of ethics, secrecy, and confidentiality were followed, conducted following the determination of Resolution n° 466/2012 of the National Health Council (*Conselho Nacional de Saúde* - CNS). The researchers pledged to have ethical conduct in the handling of data through the presentation of the Data Use Commitment Term (*Termo de Compromisso de Utilização de Dados* - TCDU).

RESULTS

Table 1 shows that most of the individuals included in this study were female (58.1%), had an average of 37.66 years old (standard deviation=17.48), and came from the southeast region of Teresina (30.3%).

Table 1 - Sociodemographic characteristics of the cases investigated for the diagnosis of COVID-19. *Teresina, Piauí,* Brazil, 2021 (n=16,449)

Variables	n (%)	Média ± Dp
Gender		
Female	9,553(58.1%)	
Male	6,896(41.9%)	
Age		37.66 ± 17.48
Region		
Southeast	4,987(30.3%)	
Mid-North	4,545(27.6%)	
South	3,586(21.8%)	
East	3,331(20.3%)	

In the clinical characteristics of the cases investigated for the diagnosis of COVID-19, we observed that the most frequent were fever (52.5%), followed by headache (43.7%), and cough (43.2%) (Table 2).

Table 2 - Clinical characteristics of cases investigated for the diagnosis of COVID-19. *Teresina, Piauí,* Brazil, 2021 (n=16.449)

Variables	Yes n(%)	No n(%)
Fever	8,637(52.5%)	7,812(47.5%)
Headache	7,195(43.7%)	9,254(56.3%)
Cough	7,101(43.2%)	9,348(56.8%)
Myalgia/arthralgia	5,834(35.5%)	10,615(64.5%)
Sore throat	5,507(33.5%)	10,942(66.5%)
Runny nose	4,197(25.5%)	12,252(74.5%)
Weakness	3,171(19.3%)	13,278(80.7%)
Dyspnea	2,421(14.7%)	14,028(85.3%)
Nausea/vomiting	975(5.9%)	15,474(94.1%)
Sputum production	292(1.8%)	16,156(98.2%)
Saturation of $O_2 < 95\%$	49(0.3%)	16,400(99.7%)

Table 3 reports that 22.30% of the sample had some risk factor for the development of complications by COVID-19. Among the risk conditions, cardiac risk factors (10.70%), diabetes *Mellitus* (5.44%), hypertension (4.80%), obesity (2.90%), and respiratory risk factors stood out (2.20%).

The risk factors raised had a statistically significant association with the positive result of the test for COVID-19, cardiac risk factor (p=0.020), diabetes *Mellitus* (p=0.000), arterial hypertension (p=0.000), smoking (p =0.013), and dyslipidemia (p=0.028). We found that being a smoker increases the chances of 2019 coronavirus infection by 2.015 times (Table 4).

Table 3 - Identification and frequency of cases identified with risk factors for the development of complications by COVID-19. *Teresina, Piauí*, Brazil, 2021 (n=16,449)

Variable	Yes n(%)	No n(%)
Risk/comorbidity factor	3,671(22.30%)	12,778(77.70%)
Risk factor type		
Cardiac	1,759(10.70%)	14,690(89.30%)
Diabetes *Mellitus*	895(5.44%)	15,554(94.56%)
Arterial hypertension	785(4.80%)	15,664(95.20%)
Obesity	485(2.90%)	15,964(97.10%)
Respiratory	366(2.20%)	16,083(97.80%)
Immunosuppression	67(0.40%)	16,382(99.60%)
Renal	45(0.30%)	16,404(99.70%)
Pregnancy	43(0.30%)	16.406(99,70%)
Chromosomal	37(0.20%)	16,412(99.80%)
Smoking	25(0.20%)	16,424(99.80%)
Neurological	19(0.10%)	16,430(99.90%)
Endocrine	15(0.10%)	16,434(99.90%)
Neoplasm	10(0.10%)	16,439(99.90%)
Rheumatology	9(0.10%)	16,440(99.90%)
Dyslipidemia	8(0.05%)	16,441(99.95%)
Hematological	6(0.04%)	16,443(99.96%)
Autoimmune	5(0.03%)	16,444(99.97%)
Gastrointestinal	5(0.03%)	16,444(99.97%)
Hepatic	3(0.02%)	16,446(99.98%)
Esophagitis	3(0.02%)	16,446(99.98%)
Leprosy	3(0.02%)	16,446(99.98%)
Mastectomy	3(0.02%)	16,446(99.98%)
Vascular	2(0.01%)	16,447(99.99%)
Puerperium	1(0.01%)	16,448(99.99%)

Table 4 - Association between risk factors and test results for COVID-19. *Teresina, Piauí*, Brazil, 2021 (n=16,449)

Risk factor	Test result for COVID-19		OR*	CI**	p-value
	Positive	Negative			
Cardiac					
Yes	809	950	1.057	1.002-1.115	0.020***
No	7,141	7,549			
Diabetes *Mellitus*					
Yes	483	412	0.890	0.836-0.947	0.000***
No	7,467	8,087			
Arterial hypertension					
Yes	444	341	0.847	0.795-0.903	0.000***
No	7,506	8,158			
Obesity					
Yes	235	250	0.997	0.909-1.095	0.497***
No	7,715	8,249			
Respiratory					
Yes	172	194	1.029	0.922-1.149	0.321***
No	7,778	8,305			

Table 4 - Association between risk factors and test results for COVID-19. *Teresina, Piauí*, Brazil, 2021 (n=16,449)

Risk factor	Test result for COVID-19		OR*	CI**	p-value
	Positive	Negative			
Immunosuppression					
Yes	29	38	1.117	0.849-1.470	0.240#
No	7,921	8,461			
Renal					
Yes	23	22	0.945	0.710-1.259	0.411#
No	7,927	8,477			
Pregnancy					
Yes	18	25	1.155	0.812-1.643	0.243#
No	7,932	8,474			
Chromosomal					
Yes	14	23	1.278	0.845-1.932	0.133#
No	7,936	8,476			
Smoking					
Yes	6	19	2.015	1.003-4.049	0.013#
No	7,944	8,480			
Neurological					
Yes	11	8	0.835	0.569-1.225	0.273#
No	7,939	8,491			
Endocrine					
Yes	7	8	1.036	0.603-1.779	0.552#
No	7,943	8,491			
Neoplasm					
Yes	6	4	0.805	0.485-1.336	0.337#
No	7,944	8,495			
Rheumatology					
Yes	4	5	1.088	0.524-2.258	0.541#
No	7,946	8,494			
Dyslipidemia					
Yes	7	1	0.552	0.425-0.718	0.028#
No	7,943	8,498			
Hematological					
Yes	2	4	1.450	0.468-4.497	0.376#
No	7,948	8,495			
Autoimmune					
Yes	1	4	2.417	0.419-13.952	0.209#
No	7,949	8,495			
Gastrointestinal					
Yes	4	1	0.604	0.390-0.937	0.167#
No	7,946	8,498			
Esophagitis					
Yes	2	1	0.725	0.326-1.614	0.475#
No	7,948	8,498			
Leprosy					
Yes	1	2	1.450	0.293-7.185	0.525#
No	7,949	8,497			
Mastectomy					
Yes	2	1	0.725	0.326-1.614	0.475#
No	7,948	8,498			
Vascular					
Yes	1	1	0.967	0.242-3.865	0.475#
No	7,949	8,498			

Legend: *odds ratio*; ** confidence interval 95%; *** chi-square test; # Fisher's exact test.

We found that the risk factor among individuals who tested positive for COVID-19 increases 5.906 times the chances of having their case referred to the emergency room (95%CI 3.559-9.801) (Table 5).

The cardiac risk factor increases 4.946 times more the chances of being referred to the emergency room than in individuals without this comorbidity (p=0.000). Diabetes *Mellitus* increases 5.639 times the chances of referral to the emergency room than individuals without diabetes (p=0.000). Those with obesity were 4.053 times more likely to be referred to the emergency room than non--obese patients (p=0.003) (Table 5).

DISCUSSION

The results of this research are added to the current scientific production aimed to understand the natural history of infection by the new coronavirus.

In general, they show the potential seriousness of the complications of COVID-19 in those who have risk factors and, in particular, hypertension, diabetes *Mellitus*, smoking, obesity, and dyslipidemia.

Although male individuals are more likely to have cases of the disease, since the X chromosome and sex hormones play an important role in women's immunity,[6] the results of this study showed a higher proportion of women among the suspected cases of COVID-19. This data is similar to a study carried out in the state of Pernambuco, Brazil, in which 58.3% of the 2,772 suspicious notifications were female.[7]

According to the 2019 National Health Survey, which dealt with primary care in the country, 69.9% of people 18 years old and over who sought the services of this care network were female, corroborating cultural aspects that women are still primarily responsible for their self-care and family care.[8]

Table 5 - Association between the approach adopted for positive COVID-19 results, a group with risk factor and type of risk factor. *Teresina, Piauí,* Brazil, 2021 (n=7,950)

| Variable | Conduct | | Total | p-value | OR*(CI95%**) |
| | Isolation and outpatient follow-up | Referred to emergency service | | | |
	n(%)	n(%)	n(%)		
Risk factor				0.000#	5.906 (3.559-9.801)
No	6,116 (76.9%)	24 (0.3%)	6,140 (77.2%)		
Yes	1,769 (22.3%)	41 (0.5%)	1,810 (22.8%)		
Type of risk factor					
Cardiac				0.000#	4.946 (2.959-8.267)
No	7,099 (89.3%)	42 (0.5%)	7,141 (89.8%)		
Yes	786 (9.9%)	23 (0.3%)	809 (10.2%)		
Diabetes				0.000#	5.639 (3.217-9.881)
No	7,419 (93.3%)	48 (0.6%)	7,467 (93.9%)		
Yes	466 (5.9%)	17 (0.2%)	483 (6.1%)		
Hypertension				0.297#	1.413 (0.565-3.537)
No	7,446 (93.7%)	60 (0.8%)	7,506 (94.4%)		
Yes	439 (5.5%)	5 (0.1%)	444 (5.6%)		
Obesity				0.003#	4.053(1.830-8.977)
No	7,657 (96.3%)	58 (0.7%)	7,715 (97.0%)		
Yes	228 (2.9%)	7 (0.1%) 7 (0.1%)	235 (3.0%)		
Respiratory				0.588#	0.705 (0.097-5.110)
No	7,714 (97.0%)	64 (0.8%)	7,778 (97.8%)		
Yes	171 (2.2%)	1 (-)	172 (2.2%)		
Smoking				0.952#	0.992 (0.990-0.994)
No	7,879 (99.1%)	65 (0.8%)	7,944 (99.9%)		
Yes	6 (0.1%)	0 (-)	6 (0.1%)		
Dyslipidemia				0.944#	0.992 (0.990-0.994)
No	7,878 (99.1%)	65 (0.8%)	7,943 (99.9%)		
Yes	7 (0.1%)	0 (-)	7 (0.1%)		

Legend: *Odds ratio; ** Confidence Interval 95%; # Fisher's exact test.

The mean age of the individuals investigated in this study was 37.66 years old. Adults, who represent a large portion of the most productive population in the labor market, may be more likely to be contaminated by SARS-CoV-2. This occurs, mainly, during the displacement to their workplace[9] and the development of work activities since many of them need to leave in isolation to maintain their source of income. Also, after flexibilization of viral containment measures - such as social isolation, leisure places, such as bars, restaurants, shopping malls, and cinemas that have returned to work - these conditions can generate agglomerations and, consequently, favor the transmissibility and emergence of new cases of the disease.[10]

In this study, fever was the most frequent clinical manifestation in cases investigated for the diagnosis of COVID-19. In a survey conducted in China with 1,099 hospitalized patients diagnosed with the disease, fever was also the most identified clinical characteristic, reaching 43.8% of patients on admission and 88.7% of these during the hospitalization.[11]

COVID-19 is characterized as a flu-like syndrome, which presents symptoms similar to colds or even the flu, caused by the influenza virus, and the respiratory system is the main locus of viral infection. The main symptoms presented are headache, fever, cough, runny nose, weakness, diarrhea, and tiredness, being considered common symptoms in mild and moderate cases.[12] However, they can progress with seriousness to complications such as respiratory failure, septic shock, thromboembolism, and multiple failures of organs.[1]

In our research, 22.30% of the sample had some risk factor for the development of complications by COVID-19, with emphasis on cardiac risk factors, diabetes *Mellitus*, arterial hypertension, obesity, and respiratory.

In addition to the systemic changes caused by the virus, risk factors such as diabetes *Mellitus* and arterial hypertension can influence the clinical status of individuals affected by SARS-CoV-2. These injuries can delay the healing process, leading to an infectious condition with complications.[13] Among people diagnosed with hypertension, diabetes *Mellitus*, and heart disease, it is also common to use medications that can harm and aggravate the condition of COVID-19.[14]

Type 2 angiotensin-converting enzyme (ACE-2), which is produced in epithelial cells in the lungs, kidneys, intestine, and blood vessels, helps bind the virus to target cells. This can represent a potential problem, as the increase in ACE-2 in the body, caused by some medications used by patients with high blood pressure, diabetes *Mellitus*, and heart problems, can favor the appearance of severe symptoms.[14]

Smoking is also a potential contributor to SARS-CoV-2 viral infection, as the lungs are the main locus of virus development. With smoking, the respiratory system becomes fragile, which facilitates the manifestation of other respiratory diseases. It is estimated that smokers are five times more likely to get flu illnesses compared to non-smokers. Also, the immune response is altered in these individuals since the act of smoking affects the response of macrophages and cytokines in combating pathogens.[15]

Dyslipidemia may represent a risk of serious infection by COVID-19.[16] People with this condition have a high level of low-density lipoproteins (LDL) and, consequently, an increase in inflammatory factors. Also, in individuals with dyslipidemia, the level of high-density lipoproteins (HDL), which are involved in the regulation of the innate immune response, is usually reduced.[17]

Pre-existing illnesses, addictions, and inappropriate lifestyles are often responsible for worrying health scenarios. In association with COVID-19, these aspects can facilitate morbidity and mortality. This is mainly due to systemic dysfunctions caused by comorbidities.[13,18,19]

In this research, individuals with some risk factors were almost six times more likely to be referred to the emergency room than those who did not have risk conditions. Research-based on the analysis of comorbidities such as cancer, diabetes *Mellitus*, dyslipidemia, cardiovascular and renal diseases showed that people diagnosed with such diseases progressed to severe cases of COVID-19 and death. This condition is especially due to changes in the functioning of organs due to viral infection in human cells, which causes signs and symptoms that generate negative responses in the coagulation cascade, in the mechanisms of regulation of sodium and potassium, and the inflammatory response, besides to the destruction of the endothelium of blood vessels, generating thrombi and serious consequences, such as embolism or stroke.[13]

In this study, we observed that people with a cardiac risk factor were approximately five times more likely to be referred to the emergency room than those who did not have a cardiac problem.

A systematic review study with meta-analysis revealed that preexisting cardiovascular diseases represent a significant risk of mortality from COVID-19 so that individuals with this factor were almost eight times more likely to have a fatal outcome due to the new coronavirus.[20]

Diabetes *Mellitus* is a disabling disease and one of the main health problems in the world. In this research, the chances of referral to the emergency room increased almost six times, compared to non--diabetics. When associated with infection by the new coronavirus, there may be a sudden worsening in the individual's health status, a fact explained by the cell binding affinity to the virus, reduced viral decrease, reduced T cell function, and increased susceptibility to hyperinflammation and storm syndrome of cytokines.[19]

Individuals with obesity were almost five times more likely to be referred to the emergency room compared to non-obese individuals. Obesity is a recognized problem and it is believed that with the COVID-19 pandemic, this condition has intensified since recent reports show an unwillingness to perform physical exercise and problems in food control.[21]

Obesity is also known to be harmful to respiratory function. Obese people tend to a deficit in innate or adaptive immunity responses. Therefore, this condition may favor a more severe clinical course during COVID-19. Obesity is also responsible for favoring the appearance of a series of diseases that are related to increased morbidity and mortality by the new coronavirus.[22]

Investigation of comorbidities in the context of SARS-CoV-2 infection carried out in a systematic review and meta-analysis study concluded that people with comorbidities are 2.4 times more likely to die from COVID-19 than those without preexisting diseases.[23]

Given the unpredictability of the behavior of the pandemic by the new coronavirus, there is a need for immediate and strategic actions.[24] Therefore, investigations are needed to clarify aspects associated with the infection, especially those related to its severe form. Thus, the indicators produced in this study reinforce the alert about the behavior of COVID-19 and raise the need for increased care among people with clinical conditions at risk for complications from the disease.

Individuals who belong to risk groups need special attention to avoid the disease.[25] In this sense, evidence shows that the adoption of measures to control the dissemination of the new coronavirus remains an important strategy to minimize the rates of new cases and their complications.[26]

This study will be the basis for the development of prevention and control measures that bring significant answers in the control of cases. Consequently, it will substantially help health professionals to face the current pandemic and being aware of the conditions that can generate susceptibility to the worsening of COVID-19 to recognize them in advance and favor assistance with more care and attention. It may also instigate studies that seek to deepen the relationship between COVID-19 and some of the variables explained to better explore and recognize its potential effects.

The limitations of the study emerge from the design, which does not allow for the assertion of causality, requiring researchers to ensure that quality data are obtained and the impossibility of exploring other variables since the data came from information provided by the health services of the aforementioned city.

For future research, we suggest the development of interventions and tools that guide the care of suspected or confirmed cases of COVID-19 in people with risk factors for the development of complications from the disease, to ensure adequate monitoring and therapy and avoid worsening of clinical conditions and its consequences.

CONCLUSION

The findings showed a statistically significant association with the test result for COVID-19 and cardiac risk factors, diabetes *Mellitus*, arterial hypertension, smoking, and dyslipidemia. We also found that having a risk factor, heart problem, diabetes *Mellitus* or obesity is related to the severity of COVID-19, represented by the conduct of referral to the emergency department. Individuals who had some risk factor - cardiac, diabetes *Mellitus*, or obesity - had, respectively, 5,906; 4.946; 5.639, and 4.053 times more likely to be referred to the emergency department.

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