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Deaths from COVID-19 and their relationship with the main comorbidities

Muertes por COVID-19 y su relación con las principales comorbilidades

Óbitos por COVID-19 e sua relação com as principais comorbidades

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Abstract

This study aimed to analyze the relationship between underlying diseases and health problems at the end of life in individuals who contracted the novel Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). A cross-sectional descriptive study with a quantitative approach was carried out based on data from the Center for Strategic Information on Health Surveillance (CIEVS), on the number of deaths between 2020-2021 from 34 Basic Health Units in a municipality in northwestern Paraná. A total of 1,187 deaths were recorded during the period 2020-2021, with the following main underlying diseases being observed: cardiovascular diseases, diabetes, chronic lung diseases, neurological and kidney diseases, involving men and women, without predominance. However, the puerperium did not result in any deaths in the period analyzed. A higher incidence of cardiovascular diseases engaged in a negative outcome against the novel coronavirus was evidenced.

Descriptors: Pandemic; SARS-CoV-2; End of Life; Deaths; Basic Diseases; Health Problems; Cardiovascular Diseases; Puerperium.

Resumén

El objetivo fue analizar la relación entre enfermedades subyacentes y problemas de salud al final de la vida en individuos que contrajeron el nuevo coronavirus Síndrome Respiratorio Agudo Severo Coronavirus 2 (SARS-CoV-2). Se desarrolló un estudio descriptivo transversal con enfoque cuantitativo a partir de datos obtenidos por el Centro de Información Estratégica de Vigilancia en Salud (CIEVS), sobre el número de defunciones entre 2020-2021 en 34 Unidades Básicas de Salud de un municipio del noroeste de Brasil. Se registraron 1.187 defunciones durante el período 2020-2021, siendo las principales enfermedades de base: enfermedades cardiovasculares, diabetes, enfermedades pulmonares crónicas, enfermedades neurológicas y renales, afectando a hombres y mujeres, sin predominio. Sin embargo, el puerperio no resultó en ninguna muerte en el período analizado. Hubo mayor incidencia de enfermedades cardiovasculares involucradas en un desenlace negativo ante el nuevo coronavirus.

Descriptores: Pandemia; SARS-CoV-2; Fin de la Vida; Fallecidos; Enfermedades de Base; Problemas de Salud; Enfermedades Cardiovasculares; Puerperio.

Resumo

Objetivou-se analisar a relação entre as doenças de base e agravos à saúde ao fim de vida em indivíduos que contraíram o novo coronavírus *Severe Acute Respiratory Syndrome Coronavirus 2* (SARS-CoV-2). Elaborou-se um estudo transversal de caráter descritivo com abordagem quantitativa a partir de dados obtidos pelo Centro de Informações Estratégicas em Vigilância em Saúde (CIEVS), sobre números de falecimentos entre 2020-2021 de 34 Unidades Básicas de Saúde de um município do noroeste do Paraná. Foram registradas 1.187 mortes durante o período de 2020-2021, observando como principais doenças de base as doenças: cardiovasculares, diabetes, pneumopatias crônicas, doenças neurológicas e renais, envolvendo homens e mulheres, sem predominância. Contudo, puerpério não resultou em nenhuma morte no período analisado. Evidenciou-se maior incidência de doenças cardiovasculares envolvidas em desfecho negativo frente ao novo coronavírus.

Descritores: Pandemias; SARS-CoV-2; Fim de Vida; Falecimentos; Doenças de Base; Agravos à Saúde; Doenças Cardiovasculares; Puerpério.

Introduction

In March 2020, the World Health Organization (WHO) declared COVID-19 a pandemic, becoming a serious health crisis. Brazil is facing a worsening situation in the fight against the disease, such as social inequalities, high unemployment rates, vulnerability, and lack of basic sanitation, such as drinking water and crowding, which further complicates the country's outlook[1].

In this context, several methods have emerged to try to contain the spread of the virus, for example, social isolation, both horizontally and vertically, associated with strategies such as the preventive approach for certain subsets of populations and a high-risk approach to reduce the impact of the disease, due to social issues[2].

Thus, specific populations were at high risk of acquiring the infection, among them the elderly, mainly due to the process of immunosenescence and the presence of chronic non-communicable diseases (NCDs)[3]. These include diabetes mellitus (DM), systemic arterial hypertension (SAH), chronic obstructive pulmonary disease (COPD), and kidney disease[4].

However, it is known that, in addition to the underlying diseases mentioned above, there are also: all types of cardiovascular diseases, lung diseases (including asthma), hematological diseases (such as sickle cell anemia), metabolic disorders (not diabetes mellitus), immunosuppression associated with the use of medications (for the treatment of HIV/AIDS, corticosteroids, chemotherapy, TNF-alpha inhibitors), obesity (defined as BMI - Body Mass Index - greater than 30 in adults, but especially above 40) and neurological disorders that may compromise respiratory action or enable a greater propensity for bronchopulmonary aspiration (Down Syndrome, Stroke, epilepsy), are considered risk factors or conditions to the health of their carriers, even though the pathophysiology involved in this predisposition is completely unknown[5].

In Brazil, obesity, as a chronic disease, associated with its risk factors: sedentary lifestyle, and physical inactivity, has increased the prevalence, in part, of the comorbidities mentioned above. In some areas of the country, such as the southeast region, approximately 40% of the population has at least one NCD, which is a risk factor for COVID-19, since the symptoms are more prevalent in these individuals when compared to the general population, including cough, palpitations, dyspnea, and myalgia. Therefore, there is a possibility of progression to severity, which consequently leads to long-term sequelae or death[6].

The puerperium is also a non-communicable health problem, and therefore deserves attention during the period of viral infection, due to the lack of studies and time to determine long-term physiological consequences in puerperal women and infants[7].

During the pandemic period, there was a sharp drop in services provided to pregnant and postpartum women, which harmed the longitudinality of care, due to Primary Health Care, represented by UBSs, being directed to emergency assistance, temporarily not acting as continuous care. Even though the pregnancy-puerperal period had anatomical, hormonal, and emotional instability, associated with the fact of continuous primary care interruption, there was a redirection to Specialized Outpatient Care (AAE), a secondary Care Network (RAS), in which the present municipality is a reference for specialized care, mainly due to the permanence of the Paraná Mother Network Program and the work of the nurse during the pandemic period, achieving comprehensiveness and continued monitoring, demonstrating that health care for puerperal and pregnant women remained and did not result in a negative outcome for puerperal women, essentially for high-risk pregnancies, women with better socioeconomic conditions and white women, as they had regular prenatal and postnatal consultations, even in the face of the temporary dissolution of Primary Care[8,9].

Thus, the question is: "What is the relationship between comorbidities and the increase in the number of deaths from COVID-19?". This study aimed to analyze the relationship between underlying diseases/health problems and the incidence of deaths in individuals who contracted the new coronavirus SARS-CoV-2.

Methodology

This is a descriptive cross-sectional study with a quantitative approach. Information from data obtained by the Center for Strategic Information on Health Surveillance (CIEVS) was used. The sample universe of this study consisted of individuals who died from COVID-19 between March 2020 and March 2021, aged 0-101 years, in a city in northwestern Paraná, composed of 34 Basic Health Units (UBS).

This municipality has received awards in the health sector, such as the INOVASUS Award in 2014 and the Paraná Public Manager Award (PGP-PR) for its post-COVID outpatient project in 2021. In addition, according to the IBGE, the municipality ranks second in the Human Development Index (HDI) in the state ranking, with a focus on the organization and functioning of the public health network. During the COVID-19 pandemic, the municipality of Paraná had to adjust to reduce the spread of the SARS-CoV-2 virus, developing strategies such as social distancing, use of masks, and closing of establishments. In addition, the city also adapted its UBS to function as a secondary RAS, thus meeting the demands of citizens affected by COVID-19.

The collection was carried out using an instrument with two stages, the first involving the understanding of sociodemographic information, obtaining variables such as sex, age, and level of education, and the second stage related to the identification of pre-existing diseases and risk factors.

After data collection, they were analyzed and organized using Microsoft Excel 2016 software and the Statistical Package for the Social Sciences (SPSS) software, version 21.0; and with the help of the R (R Development Core Team) statistical environment, version 3.3.1.

To describe the results, the absolute frequency and the percentage will be used for the categorical variables. The absolute frequency (ni) is given by the number of times a given variable assumes a given value/category in question.

The percentage (pi) is the result of the ratio between the absolute frequency and the sample size, multiplied by 100, that is, $100 \cdot \frac{n_i}{n}\%$.

To assess the difference between the proportion of characteristics of patients who died and the population of the municipality, the test for comparison of proportions will be used. The Z test statistic of the test is given by: $T = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\frac{\hat{p}(1-\hat{p})}{n_1} + \frac{\hat{p}(1-\hat{p})}{n_2}}}$ where $\hat{p}_1$ and $\hat{p}_2$ are the proportions of companies that meet the requirements of groups 1 and 2, n_1 and n_2 are the sample sizes of groups 1 and 2, respectively, and $\hat{p} = \frac{\widehat{n_1}\overline{p}_1 + n_2\hat{p}_2}{n_1 + n_2}$, the weighted average of $\hat{p}_1$ and $\hat{p}_2$[10].

The ethical precepts of the research are under the disciplinary guidelines provided for by Resolution No. 466/12 of the National Health Council, under CAAE: 45730621.6.0000.5539, after the release of the site.

Results

In 2020, among the 34 UBSs, 312 deaths from COVID-19 were recorded, and in 2021, 875, resulting in 1,187 deaths. Females and males were also present, with no predominance or bias in data collection. Regarding the comorbidities recorded by patients who died due to COVID-19, Table 1 shows that the most common was chronic cardiovascular disease, which affected 44.05% of individuals, followed by other comorbidities in addition to those listed (27.85%) and diabetes (27.34%). Among other underlying diseases, neurological (6.16%), chronic renal (5.57%), and pulmonary (4.39%) alterations also stand out. The frequency of each of the other comorbidities evaluated did not exceed 10%.

Table 1. Frequency distribution of comorbidities of patients who died from COVID-19. Maringá, PR, Brazil, 2020-2021

Comorbidities	No		Yes	
	N	%	N	%
Chronic cardiovascular disease	663	55.95%	522	44.05%
Other comorbidities	855	72.15%	330	27.85%
Diabetes	861	72.66%	324	27.34%
Obesity	1092	92.15%	93	7.85%
Chronic neurological disease	1112	93.84%	73	6.16%
Chronic kidney disease	1119	94.43%	66	5.57%
Other chronic lung disease	1113	95.61%	52	4.39%
Asthma	1153	97.30%	32	2.70%
Liver disease	1166	98.40%	19	1.60%
Immunodeficiency/ immunosuppression	1170	98.73%	15	1.27%
BMI	1170	98.73%	15	1.27%
Chronic hematologic disease	1173	98.99%	12	1.01%
Down syndrome	1180	99.58%	5	0.42%
Puerperal woman (up to 45 days after delivery)	1185	100%	0	0.00%

In general, it was evident that the two main comorbidities associated with a negative outcome were chronic cardiovascular disease and diabetes. This study did not demonstrate a relationship between the puerperium and deaths due to COVID-19 infection, as no deaths of postpartum women were recorded between 2020 and 2021.

Discussion

During the COVID-19 pandemic, there was consideration of the relationship between the incidence of certain diseases associated with deaths[11]. Thus, the present study, carried out in a municipality in the northwest of Paraná, highlights the main comorbidities, mainly those related to NCDs, in order of prevalence.

Among them, chronic cardiovascular diseases are associated with up to 35% of patients, therefore, they have a high prevalence[12]. An interesting fact is that the prevalence found is different among the studies that noted that heart disease represented a lower prevalence than other diseases in the study, ranking fourth, with 8%, behind high blood

pressure, diabetes, and asthma[6]. In the present study, chronic cardiovascular disease is in first place, with a prevalence of 44.05% in mortality within two years. In addition, over the last few decades, there has been an increase in cardiovascular diseases, affecting around 6% of the general population[13]. A fact that corroborates this data is that in the municipality where the study was carried out, the incidence of deaths in individuals over 60 years of age was higher.

In addition, another very prevalent comorbidity in deaths from COVID-19 was Diabetes Mellitus. Even though its prevalence in the world population is approximately 9%, Brazil has 12.5 million adults between 20 and 79 years old affected by the disease, causing complications from the NCD itself, mainly over 60 years old, in which the total mortality from the disease represents approximately 10% unrelated to COVID-19[14]. In this study, diabetes as an underlying disease related to the number of deaths accounts for 27.85%, occupying the second position, corroborating the statistical data of the study[6] and the Paraná Epidemiological Bulletin of February 8, 2023[15].

Another relevant point is related to obesity, a NCD, defined as a BMI greater than 3016. The prevalence in the general population of Brazil went from 11.3% in 2006 to 20.3% in 2019, representing an increase of 72% in thirteen years[17]. Therefore, the present study demonstrated a greater association between COVID-19 and obesity-related deaths, with a prevalence of 7.85%. In addition, it was observed that a BMI greater than 30 was responsible for 94.1% of the risk of needing an ICU and 88.9% of the risk of death among the sample universe, composed of adults infected with the virus. It is crucial to emphasize that BMI was selected not only due to excess total body fat, as there may be individuals with high BMI due to excess muscle mass, associated or not with excess adipose tissue. However, it can be inferred that the prediction of severity that obesity determines during active infection and/or during post-COVID recovery for a yet undetermined period[17,18].

Specifically, regarding asthma, a current study demonstrated that it is a chronic lung disease that correlated with the highest number of deaths, and therefore, a higher prevalence compared to other lung diseases of the respiratory system, with a prevalence of 9%, second only to hypertension and diabetes[2]. At the beginning of the pandemic, Brazil correlated asthma with an increased risk of hospitalization and death from COVID-19; treatment in asthmatic adults and children was more efficient and expensive, in terms of availability of resources, resulting in the possibility and even a process of scientific investigation that, in controlled asthma, in adults and children, does not represent a risk factor for the disease[19]. An interesting fact to discuss is the relationship between the prevalence of asthma and mortality (2.7%) when compared to other chronic lung diseases since its prevalence is higher, a scenario like the rest of Paraná, as data from the State Health Department shows 1.39%.

Regarding chronic kidney disease (3.18%) and chronic neurological disease (6.16%), the data showed equal positions compared to the Paraná Epidemiological Bulletin[14], representing 5.77% and 4.22%, respectively.

Two others have differences in percentages, and therefore positions, compared to the work in the epidemiological bulletin, for example, liver disease and immunodeficiency/ immunosuppression. The first occupies 1.06%, in eighth place, while in the Bulletin it occupies 0.78%, in ninth place. The second disease is in ninth place, with 1.27%, and, in the Bulletin, 1.73%, in seventh place[14].

Finally, it is important to highlight that the second position in Table 1, referred to as "other comorbidities", encompasses several diseases that were not the focus of the study, whether isolated or combined.

In this city in northwestern Paraná, no cases of death among postpartum women were identified, but it is worth noting that the Bulletin[14] has recorded 33 deaths of postpartum women (0.04% of total deaths) since the beginning of the pandemic. Two factors were decisive for better care provided to pregnant and postpartum women in this city compared to municipalities in Paraná: the permanence of the service provided by Paraná Mother Network and the performance of nurses, whose professional category in health has proven to be one of the most affected at a psychosocial level, due to fear of contagion, excessive workload and the emotional aspect caused by the pandemic[9,20].

Conclusion

Based on the results, it is possible to conclude that between March 2020 and 2021, there was a high number of deaths among some comorbidities, with a prevalence of chronic cardiovascular disease, followed by diabetes mellitus, obesity, neurological disease, chronic kidney disease, asthma, chronic liver disease, immunodeficiency/ immunosuppression, chronic hematological disease, and Down syndrome, showing a relationship between the comorbidities mentioned above and the number of deaths.

However, it is important to highlight the preparation of the municipality's technical team, both by the health professional categories and the administrative staff, in the face of the redirection and physical and operational reallocation of the RASs in the face of the fight against COVID-19. Even though the scientific literature knows much of the pathophysiological relationships between the most prevalent diseases associated with deaths from COVID-19, the complete mechanism of the systemic repercussions that the virus can trigger in the short and long term is unknown.

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