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Analysis of cases of deaths from covid-19 in the state of Paraná: A cross-sectional study

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ABSTRACT
Introduction: After the first cases of COVID-19 emerged, we realized that some groups of people were more affected than others. When we analyze the cases of the disease and deaths, the literature reports that there is a higher incidence of the disease in the adult population, but the lethality is higher in the elderly. Objective: To analyze the cases of deaths from COVID-19 in the State of Paraná. Method: This is a descriptive, cross-sectional, and retrospective study, with a quantitative approach, based on secondary data in the public domain, made available by the State Health Secretariat of the State of Paraná (SESA-PR), from March 2020 to March 2021. Results: The State of Paraná reported 16,571 cases of deaths from COVID-19, meaning that 2.1% of the cases, over 18 years of age, notified with the disease, had a negative outcome. The disease was more lethal in the elderly (74.6%) than in the adult population (25.3%). When we stratified the deaths of adults and elderly by sex, we observed that in both adults (61.8%) and the elderly (56.8%) the highest number of deaths was in men, compared to adult women (38.1%) and elderly women (43.1%). However, when we stratified the number of cases of deaths by age group and sex in the adult and elderly population, the number of deaths was higher in older men, in the age group between 41 and 59 years, about 80.9% of deaths. In the elderly population, the highest number of deaths also occurred in the male elderly, aged between 70 and 79 years, representing about 36.8% of the deaths. Final considerations: The results of the study suggest that age and gender are variables that may interfere in the establishment of risk groups for the disease and may also be related to different outcomes, especially death. Other results show that when we analyze the distribution of cases of the disease and deaths by age group, in Brazil and worldwide, there is evidence that there is a higher incidence of the disease in the adult population, however, the lethality is higher in the elderly population. Although COVID-19 is less lethal compared to other epidemics caused by the coronavirus, its power of transmissibility is much higher affecting mainly the elderly, men, and those with comorbidities, the findings in this study also show the increase in deaths in men when compared to what was observed in women, which are similar to some literature.

Keywords: Elderly, men, COVID-19, death records.

1 INTRODUCTION

At the end of the year 2019 in the city of Wuhan, in Hubei province, People's Republic of China the first cases of pneumonia of unknown origin were identified, after some investigations began to suspect a disease of zoonotic origin since the first confirmed cases were of regulars and workers of the wholesale seafood market of the region. [8,22] Scientifically the disease has been classified as an

infectious disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), its transmission is potentially severe and of high distribution, the most common symptoms may include: cough, difficulty breathing, sore throats, fever, and other clinical manifestations. [8.9]

The disease is highly contagious, it can be transmitted in various ways, from person to person in confirmed cases, through respiratory droplets produced and excreted during coughing, sneezing, speech, and contaminated objects and surfaces such as cell phones, doorknobs, tables, and among others, in addition, another form of transmission is by asymptomatic or mildly symptomatic people. [5.19]

Faced with this high transmissibility, on January 30, 2020, the World Health Organization (WHO) declares an epidemic of COVID-19 in China, characterized as a Public Health Emergency of International Importance (PHEIC), but only on March 11, 2020, that the WHO changed the status of the disease to pandemic. [9.13]

In Brazil the first case of the disease was registered on February 26, 2020, it was an elderly resident in the city of São Paulo, with a history of travel to Italy, but the first case of death in the country was recorded on March 17, 2020, and it was an elderly person also living in São Paulo, with a history of diabetes and hypertension, but no record of travel abroad. [7.23] In the State of Paraná, the first case of COVID-19 was recorded on March 17, 2020, and the first death was reported after 10 days. [13th]

After the records of the first cases of COVID-19, several actions were implemented to contain and mitigate the advance of the disease, however, the measures were not enough to prevent deaths from COVID-19, in addition to the losses due to death the pandemic also brought certain concerns to the mental health of the population, causing psychological and social disturbances that affect the whole society, be it children, adolescents, adults and the elderly, at different levels of intensity. [2,9,16]

In this epidemiological context, as of October 18, 2020, 39,596,858 cases diagnosed with COVID-19 and 1,107,374 deaths have been recorded worldwide. In the same period, 5,200,300 confirmed cases of the disease and 163,214 deaths were recorded in Brazil, and 197,444 confirmed cases and 4,875 deaths were reported in the State of Paraná. [5]

Given the severity and rapid proliferation of the disease, it was noticed that some groups of people were more vulnerable to the disease to the detriment of others. The elderly, for example, are in the group most vulnerable to developing the various complications arising from the new coronavirus. The cases of deaths in the elderly have been increasing since its emergence. [7,22,29] In the countries that faced the initial epidemic, the overall mortality rate was approximately 3%, however, this may change with advancing age. In children and young people, the number of deaths does not reach 1%. In contrast,

in the elderly over 70 years the deaths reached 8%, and in the elderly over 80 years this number rose to almost 15%. [6.15]

There are reports in the literature that mortality may be higher when the disease is associated with risk factors such as severe lymphopenia, high levels of C-reactive protein that is correlated with the severity of hypoxemia, male gender, race/skin color, low socioeconomic status, diabetes mellitus (DM), arterial hypertension (SAH), cancer and older age (≥60 years), where older age groups tend to have a higher proportion of comorbidities than young people. However, these factors can be minimized, depending on the characteristics of the population and health services, so more studies are needed that may be useful to know the local realities and subsidize health actions based on these realities. [1,10,24]

When analyzing the distribution of cases of the disease and deaths by age group, in Brazil, and in the world, it is observed that there is a higher incidence of the disease in the adult population, however, the lethality is higher in the elderly population. [3] In a study conducted in Brazil, data indicated that as of June 3, 2020, 35,126 elderly people had died, corresponding to 71% of the total deaths from COVID-19 in the same period, associated with at least one risk factor. [26th]

In another study conducted on May 25, 2020, they reported that the highest proportion of cases and deaths in the elderly was observed in the states of Pará (22.36%) and Rio Grande do Sul (84.44%), and the lowest proportions, recorded in the states of Bahia (3.90%) and Amazonas (37.66%). [4]

Although COVID-19 is a globally known and studied disease, and scientific studies have made some progress on the coronavirus, there are still many gaps in the scientific world, that is, there are few studies that talk about the outcomes of the disease, especially about the epidemiological profile of cases and deaths, so these gaps need to be studied and unraveled. [28th]

It is known that COVID-19 has made many victims throughout the Brazilian state, however, we do not know for sure what the impact of the disease is on the people of Paraná, more specifically on the cases of deaths. In this sense, it is important to know the epidemiological profile of deaths, which is under construction, because every day new cases of death are reported, to make the population aware of the potential deleterious effect of the disease. To this end, the study aimed to analyze the cases of deaths from COVID-19 in the State of Paraná.

2 METHOD

This is a descriptive, cross-sectional, and retrospective study with a quantitative approach, carried out through documentary analysis of secondary and public domain databases, made available by the State Health Secretariat of the State of Paraná (SESA-PR), from March 2020 to March 2021.

As inclusion criteria, data referring to people over 18 years of age, grouped into two categories: adults (18 to 59 years old) and elderly people over 60 years old, living in the State of Paraná and diagnosed with COVID-19, were included in the study. Non-residents of the State of Paraná were excluded from the study and incomplete and/or incorrect data were discarded.

Data collection was performed by an investigator, considering the following variables gender, age group, city of residence, onset of symptoms, date of death, and number of deaths. The searches for the data were made by consulting the Coronavirus Epidemiological Report Bulletin (COVID-19) in CSV format, available at the link https://www.saude.pr.gov.br/Pagina/Coronavirus-COVID-19. In all, in this period, 781,625 confirmed cases of COVID-19 were reported in Paraná, these cases come from 401 cities in Paraná.

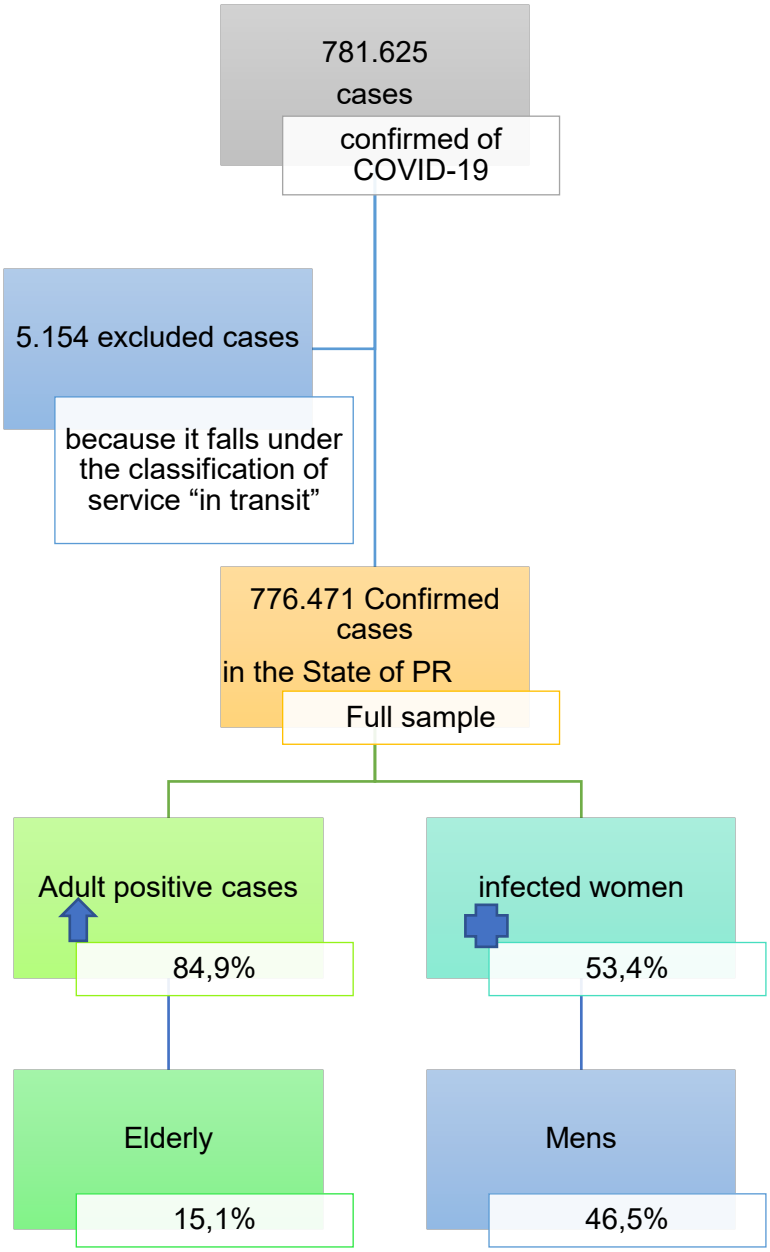
The data used in the research were tabulated in a spreadsheet in the Microsoft Office Excel® version 2019 program. These data were analyzed using frequency. From the tabulation, the program's filters were used to obtain the confirmed cases of COVID-19 in adults and the elderly.

3 RESULTS

The results obtained in this study were performed through the documental analysis of confirmed cases and deaths, using the data provided by SESA-PR in the period from March 2020 to March 2021.

The flowchart of confirmed cases is shown in Figure 1.

Figure 1 - Flowchart of study participants confirmed and discarded cases of COVID-19 in the State of Paraná, 2021.



Source: Coronavirus Epidemiological Report Bulletin – SESA - PR (2020 to 2021)

Regarding deaths, the data show that 2.1% of the population infected by COVID-19 had death as an outcome. Mortality was higher in the elderly (74.6%) than in the adult population (25.3%), as shown in Table 1.

Table 1 – Characterization of COVID-19 death cases in the State of Paraná, 2021

	n	%
Adults	4.197	25,3%
Elderly	12.374	74,6%
Total deaths	16.571	2,1%

Source: Coronavirus Epidemiological Report Bulletin – SESA - PR (2020 to 2021)

On the other hand, when we stratified the deaths of adults and the elderly by sex, we observed that both adults (61.8%) and the elderly (56.8%) had the highest number of deaths in men, compared to adults (38.1%) and elderly women (43.1%), as shown in Table 2.

Table 2 - Characterization of COVID-19 death cases by sex in the State of Paraná, 2021

	Men	%	Women	%
Total adult deaths (n = 4,197)	2.594	61,8%	1.603	38,1%
Total number of elderly deaths (n = 12,374)	7.029	56,8%	5.345	43,1%

Source: Coronavirus Epidemiological Report Bulletin – SESA - PR (2020 to 2021)

However, when we stratified the number of cases of deaths by age group and sex in the adult population, we observed that the trend of death is higher in men, in the age group between 41 and 59 years, with about 80.9% of deaths. However, when we performed this same analysis in the elderly population, we found that the highest number of deaths also occurred in the male elderly, especially in the age group of 70 to 79 years with 36.8% of the deaths, as shown in Table 3.

Table 3 – Cases of deaths by age group and sex in adults in the State of Paraná, 2021

Age group	Men (n = 2.594)	%	Women (n = 1.603)	%
18 a 29	107	4,1%	73	4,5%
30 a 40	387	14,9%	230	14,3%
41 a 59	2.100	80,9%	1.300	81,0%
60 a 69	2.430	34,5%	1.639	30,6%
70 a79	2.588	36,8%	1.875	35,0%
80 an 89	1.629	23,1%	1.395	25,0%
90+	382	5,4%	436	8,1%

Source: Coronavirus Epidemiological Report Bulletin – SESA - PR (2020 to 2021)

Finally, another data analysis in the study was the relationship between the time elapsed from the date of onset of symptoms to death. To analyze this variable, 2,202 cases were excluded from the sample because they contained *missing,* leaving 14,369 deaths. Through this analysis, we obtained an overall average of 21.91 days between the onset of symptoms and the date of death. When separated by age group, the time increased for the group of adults at 22.87 days and decreased for the group of elderly at 21.58 days.

4 DISCUSSIONS

The present study showed a significant number of people who were infected by COVID-19 throughout the State of Paraná and in many cases had a negative outcome, such as death. The results indicate that in the 12 months, 2.1% of the population with COVID-19 died, indicating that this average was lower compared to national data11, which was 54.4 deaths per 100,000 inhabitants, considering the beginning of the pandemic until the 34th Epidemiological Week. In the State of Rondônia, the

mortality rate was higher than the Brazilian average, 59.7 deaths per 100,000 inhabitants. [11] In another study released by the Ministry of Health20 on 09/12/2021 Brazil recorded the lowest moving average of deaths from COVID-19, on last epidemiological bulletin released, the drop was 18.78% compared to the last 14 days and 93% since the peak of the pandemic, recorded in April 2021. This drop occurred due to the advance of the Vaccination Campaign.

Another important result in our study indicates that the variables age and sex may be related to cases of mortality from COVID-19 since deaths occurred more in elderly males. Since the beginning of the pandemic, the elderly has been considered a risk group, both for contracting the disease and for worsening symptoms and consequently death. This outcome is corroborated by studies that report a higher incidence of the disease in adults, but with a higher mortality rate in the elderly, a hypothesis for the increase in the number of deaths may be associated with the presence of changes in the immune system that are typical of the age. [14] And the prevalence of chronic diseases, common in the elderly, can increase the severity of the disease. Therefore, determining the lethality and severity of COVID-19 can help public health services protect the most vulnerable groups. [18,25,27]

In our study, both in the adult population and in the elderly population, mortality was higher in men, suggesting that males are more vulnerable to negative outcomes. Studies indicate that the gender variable may be a factor associated with mortality rate, but genetic, behavioral, and lifestyle factors should also be considered. [4,14,30] When it comes to aspects related to gender, the scientific literature points to greater male vulnerability to COVID-19 due to organic responses to infection, with emphasis on hormonal and chromosomal function, the presence of previous comorbidities and the maintenance of unhealthy patterns, habits, and lifestyles. [14th]

Another result found is that in the adult population, most deaths occur in older men, aged between 41 and 59 years. This data is corroborated by studies that show that people over 50 infected by the coronavirus are 2 times more likely to progress to the most severe form of the disease. [27] Possibly, due to work where this population is more exposed to the virus, since it is not always possible to maintain social distancing, thus increasing the risks of infection and consequently a greater chance of death. Male morbidity and mortality from COVID-19 are higher than female morbidity and mortality in several countries around the world. This is because, historically, men do not usually take care of themselves in addition to having greater exposure to health risk factors, and the search for medical care is undertaken in a phase of greater severity of the disease. [11.33]

In the elderly population, the highest number of cases of death occurred in the elderly, in the age group of 70 to 79 years. According to the literature, the risk of death from COVID-19 tends to increase with advancing age, since most deaths occur mainly in the elderly, especially those with chronic diseases. [21.28]

On the other hand, some literature indicates that of people aged 80 years or more 14.8% of those infected died, compared with the elderly aged 70 to 79 years at 8.0% and those aged 60 to 69 years with 8.8%, presenting a rate of 3.82 times higher than the general average, this serves as a warning to the health authorities, to develop strategies to protect the health of the elderly. [4] Therefore, advanced age is seen as a risk factor for the disease, increasing the chances of developing severe acute respiratory syndrome (SARS). [21st]

Although there are not many studies that explain the true reason why men have the worst clinical outcomes, then women by the new coronavirus, a justification, pointed out by the literature, is related to hormonal issues, such as the presence of estrogen, a sex hormone present in cisgender women and trans men, it is believed that this hormone can stimulate the immune response and make these people more protected. [31] On the other hand, some studies suggest that COVID-19 contamination may have a predilection for sex; in previous SARS and MERS epidemics, men were also more likely to be infected than women. This may be related to the important role that a woman's X chromosomes and sex hormones play in the body's immune system. Another assumption is that men are laxer about complying with rules and many have not carried out the quarantine period correctly. [17th]

Regarding the time elapsed between the onset of symptoms and death as an outcome, the average found in days is higher than that recommended by the literature. This leads us to suppose that the treatment offered to the patient was able to postpone, but was not enough to avoid death. There are not many studies that show the time traveled from the onset of symptoms to death from COVID-19, however, in some literature, they bring a variation in the time intervals from the onset of symptoms to death, of approximately 14 days. [17.32]

This study has some limitations, such as the lack of some data that could provide more elements of analysis such as sociodemographic data (race, color, social class, marital status), clinical condition (comorbidities), and incomplete and incorrect data in the bulletins, which made some analyses difficult. However, despite the limitations, this study provided relevant facts about the profile of deaths, which can assist in prevention strategies and assist in the provision of evidence-based health services.

5 CONCLUSIONS

While the occurrence of COVID-19 infection was higher in adults, the disease was more lethal for the elderly. Making this population the most vulnerable group to negative consequences and serving as a warning for health professionals to develop strategies to protect the health of the elderly. In addition, mortality was higher in both adults and the elderly in males, drawing attention to the clinical condition of men.

Since the arrival of the pandemic, several challenges have been thrown at researchers, health professionals, and managers, about the search for strategies to prevent the health system from overloading and the number of deaths from increasing even more. Therefore, with the results obtained in this study, health professionals working in Basic Health Units (BHU) will be able to outline strategies to meet this demand of patients, focusing on specific guidelines or tactics to meet each need that risk groups may present and thus reduce hospitalization.

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