

Comparison of the COVID-19 fatality rate between children, youth and elderly population in Paraíba

Comparison of the COVID-19 fatality rate between the infant-juvenile and elderly population in Paraíba

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Summary

Objective: To compare the mortality rate due to COVID-19 between the child and elderly population in Paraíba. **Material and methods:** Documentary research was carried out, carried out in three stages: pre-analysis, organization of the material and data processing. Therefore, we sought to collect data on confirmed cases and deaths in the child, youth and elderly populations of the Paraíba region according to the Epidemiological Bulletin on COVID-19 of the state from February 2020 to September 2021. **Results:** A higher rate of COVID-19 lethality in the elderly population when compared to children (20.3% and 0.12% respectively), a value approximately 169 times higher. This reason can be explained due to the multimorbidity that exists in older individuals, such as systemic arterial hypertension, heart disease, diabetes mellitus, obesity and other conditions that include respiratory, neurological or renal disease, smoking, neoplasia, immunosuppression, alcoholism, hematological or liver disease and mental disorders. **Conclusion:** Children probably tend to present milder symptoms and a better prognosis than other age groups. In the elderly, the mortality rate was higher and may be related to the comorbidities present in senile individuals.

Keywords: COVID-19; Children; Elderly.

Abstract

Objective: To compare the covid-19 fatality rate between the infant-juvenile and elderly population in Paraíba. Material and methods: A documentary research was carried out in three stages: pre-analysis, material organization and data processing. Therefore, we sought to collect data on confirmed cases and deaths in children, youth and elderly populations in the region of Paraíba, according to the State Epidemiological Bulletin on COVID-19 from February 2020 to September 2021. Results: There was a higher lethality rate by COVID-19 in the elderly population when compared to children (20.3% and 0.12% respectively), a value approximately 169 times higher. This reason can be explained by the multimorbidity existing in older individuals, such as systemic arterial hypertension, heart disease, diabetes mellitus, obesity and others

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conditions that are divided between respiratory, neurological or renal disease, smoking, cancer, immunosuppression, alcoholism, hematologic or liver disease and mental disorders. Conclusion: Children probably tend to have milder symptoms and a better prognosis than other age groups. In the elderly, the mortality rate was higher and it can be related to comorbidities present in senile.

Keywords: COVID-19; Children; Elderly.

1. Introduction

In the early stages of the pandemic due to respiratory syndrome infection severe acute illness caused by coronavirus-2 (SARS-CoV-2), the majority of cases it was concentrated in middle-aged and elderly people. With the persistence of the ongoing pandemic situation, children began to present an increasing tendency for infection in many countries due to world (CUI *et al.*, 2020a; CUI *et al.*, 2020b; ROSTAMI *et al.*, 2020).

Studies carried out around the world indicate that the main characteristics clinics presented by children infected with coronavirus (COVID-19) are fever, cough, sore throat, tachycardia, rhinorrhea, nasal congestion, tachypnea, diarrhea, nausea and vomiting, myalgia, fatigue, hypoxemia and pain thoracic. In children under one year of age, symptoms of fever, cough, rhinorrhea, nasal congestion, tachypnea and vomiting were the most common. Both symptoms can vary in severity depending on the degree and severity of infection (CUI *et al.*, 2020b; GONÇALVES *et al.*, 2020; LADHANI *et al.*, 2020).

The main laboratory tests to be requested in cases of suspected or suspected COVID-19 infection are blood count, function tests hepatic function, measurement of renal function, cardiac function, inflammatory markers and D-dimer. The main changes expected are leukocytosis or leukopenia, C-reactive protein, procalcitonin and lactic dehydrogenase (markers inflammatory diseases), elevated liver enzymes (ALT and AST), creatine-kinase and CK-MB (cardiac function parameters) may be elevated. The D-dimer may be elevated in some cases, with a greater risk of pulmonary thromboembolism. In children under one year of age, most common changes are lymphopenia, elevated inflammatory markers, elevation of liver enzymes and myocardial injury markers (CUI *et*

al., 2020a; LADHANI *et al.*, 2020; MURILLO-ZAMORA *et al.*, 2020; ROSTAMI *et al.*, 2021).

Studies have shown that infection with the new coronavirus affects adults and children differently. COVID-19 infection in children, when compared to adults, showed a greater tendency to present elevations in myocardial injury enzymes (CK and CK-MB), which may indicate a greater predisposition to the development of heart damage in children (CUI *et al.*, 2020b; CAI *et al.*, 2020).

The severity of the infection is classified according to the characteristics clinical presentations, laboratory tests, chest imaging exams and They include asymptomatic, mild, moderate, severe and critical cases. Asymptomatic infection: the child has no clinical signs or symptoms, normal chest imaging exam, with only the DNA test for COVID-19 positive. Mild infection: acute upper respiratory tract infection is the main manifestation and some children may only present symptoms digestive. Some children may not have a fever and the physical examination may not be auscultatory abnormalities (CUI *et al.*, 2020a; CAI *et al.*, 2020; HAN *et al.*, 2020; RAJAPAKSE; DIXIT, 2020).

The other possible conditions are moderate infection: with pneumonia, with a predominance of fever and cough, with a dry cough at first and then a cough with phlegm. Some children may have wheezing but no signs of hypoxia, such as difficulty breathing and sputum or dry snoring and/or snoring moist sound can be heard in the lungs. Some children may present lung lesions on chest computed tomography (CT) without any clinical symptoms and signs, which is called subclinical type. Severe infection: early onset of respiratory symptoms such as fever and cough, may be accompanied by gastrointestinal symptoms, such as diarrhea and pain abdominal. Disease progression usually occurs in about a week, with development of hypoxia and dyspnea, with oxygen saturation less than 92% (CUI *et al.*, 2020a; HAN *et al.*, 2020; LAWS *et al.*, 2020; RAJAPAKSE; DIXIT, 2020).

The last picture is critical infection: children can progress rapidly to acute respiratory distress syndrome or respiratory failure respiratory. There may also be shock, coagulation disorders or dysfunction

multiple organs, which poses an imminent risk of death. The main changes found on imaging tests are: normal, glass opacity matte, local irregular shading, bilateral irregular shading, alteration white lung disease and pleural effusion and depend on the severity of the infection and clinical classification of the disease (CUI *et al.*, 2020a; HAN *et al.*, 2020; RAJAPAKSE; DIXIT, 2020).

In contrast to this population group, the risk of death from COVID-19 increases with age and most deaths observed are in people over the age of 60, especially those with chronic illnesses such as diabetes mellitus, systemic arterial hypertension, kidney disease, cardiovascular and other conditions. The global spread of the pandemic has produced disproportionate effects on older people, increasing the risk of inequity in health systems and an even greater marginalization of older people (LLOYD-SHERLOCK *et al.*, 2020).

Internationally, health authorities are warning more people older women that they are at greater risk of developing more serious illnesses or complications due to COVID-19 infection. Public health policies must consider the considerable number of elderly people, particularly those who live alone or depend on others for care and support.

Social isolation and loneliness are two factors that have a strong impact on health mental and physical health of the elderly, which can also generate complications such as anxiety, depression, cognitive dysfunction, heart disease and high mortality. Both These factors can contribute to a state of immunosuppression and a greater predisposition to SARS-CoV-2 infection (BROOKE; JACKSON, 2020; LLOYD-SHERLOCK *et al.*, 2020).

The severity and outcome of COVID-19 infection largely depend on the patient's age. Adults over 65 years of age represent 80% of hospitalizations and have a 23 times greater risk of death than those with less than 65 years old. In the clinic, patients with COVID-19 most commonly present fever, cough and dyspnea, and from there the disease can evolve into syndrome acute respiratory distress, lung consolidation, release of cytokines, endotheliitis, coagulopathies, multiple organ failure and death. Comorbidities such as cardiovascular diseases, diabetes, hypertension systemic arterial disease, respiratory system diseases and obesity increase

chances of fatal diseases and severity of infection, but in itself it does not explain why age is an independent risk factor (LITHANDER *et al.*, 2020; MUELLER; MCNAMARA; SINCLAIR, 2020).

Important factors that can influence the course of infection in people elderly women include the presence of comorbidities, immunosuppression states, chronic diseases and physical and mental health. The chances of developing severe acute respiratory distress syndrome are higher in the population elderly and this stage is characterized by neutrophilia, lymphocytopenia, consolidation lung disease and bilateral peripheral and nodular ground-glass opacities in chest x-rays (LITHANDER *et al.*, 2020; MUELLER; MCNAMARA; SINCLAIR, 2020).

The main differential factor that can contribute to the severity of symptoms in younger populations, when compared to older ones, is the immune system, which in children produces an immune response controlled in contrast to a suppressive immune response in older people old, with cytokine storm due to immunosenescence. Your immune response mechanisms tend to be more dysfunctional and heterogeneous in the elderly population (LITHANDER *et al.*, 2020; MUELLER; MCNAMARA; SINCLAIR, 2020).

Therefore, the present study aims to compare the mortality rate by COVID-19 among the young and elderly population in Paraíba. It was chosen for choosing the theme due to the importance of knowing the main risk factors for the development of serious illness in the elderly population and what are the predictors of mortality in the same.

2. Material and methods

This study is a documentary research carried out with data on COVID-19 in the State of Paraíba. According to Marconi and Lakatos (2019), this type of investigation has as a striking characteristic the use of data collection source from documents, which constitute as primary data sources.

The state of Paraíba is located in the Northeast Region, being one of the 27 federative units of Brazil. Therefore, it has 223 municipalities and according to with the Brazilian Institute of Geography and Statistics (IBGE), in 2020, its

population was estimated at 4,039,277 inhabitants. Of these, 34.8% (N^y1,405,668) are in the juvenile age group (0-19 years) and 11.9% (N^y480,673) in the elderly (60 years or more).

Thus, we sought to collect data from the Epidemiological Bulletin on COVID-19 of Paraíba, specifically, regarding confirmed cases and deaths in children, youth and elderly populations in the Paraíba region from February 2020 to September 2021.

Therefore, the documentary research outlined included the three stages outlined by Marconi and Lakatos (2019) as necessary: pre-analysis, organization of material and processing of data.

I - Pre-analysis: the objectives of the research must be defined document, what questions should be answered based on the analysis of the data. Here, the following questions were defined: Is there a difference in the rate of lethality due to COVID-19 among the young and elderly population? What are the factors that may influence the difference between the fatality rate between these two populations?

II – Organization of the material: aims to facilitate interpretation of the data. The data is chosen for analysis and reading of the information for selecting the main information to be used. The gathering data collection was based on data available in the Epidemiological Bulletin on COVID-19 in Paraíba.

III – Data processing: the information is analyzed and construction of the argument to answer the research question. Searched here bring existing information in the literature to understand the data collected from children, youth and elderly populations in Paraíba affected by COVID-19. The COVID-19 fatality rate in the state was estimated, in which the percentage of infected individuals who died was measured, according to the formula in the sequence (PEREIRA, 2001).

$$\text{Fatality rate} = \frac{\text{Number of deaths due to the disease in a given area and period} \times 100}{\text{Total number of people with the disease in the same area and period}} \text{ or } 1000$$

Due to the nature of the research, there was no need to submit the proposal to the Research Ethics Committee, since the data was public.

3. Results

Table 1 shows the number of confirmed cases of infection by COVID-19 in the age groups 0-19 years and 60 years and over. Regarding the total number of confirmed cases in Paraíba (N=440,856; N=100%), it can be stated that the number of COVID-19 infections in the child and youth population corresponded to 4.16% and in the elderly it corresponded to 6.68%.

Table 1: Confirmation of confirmed cases of COVID-19 in the child and youth population (0-19 years) and in the elderly (60 years or more)

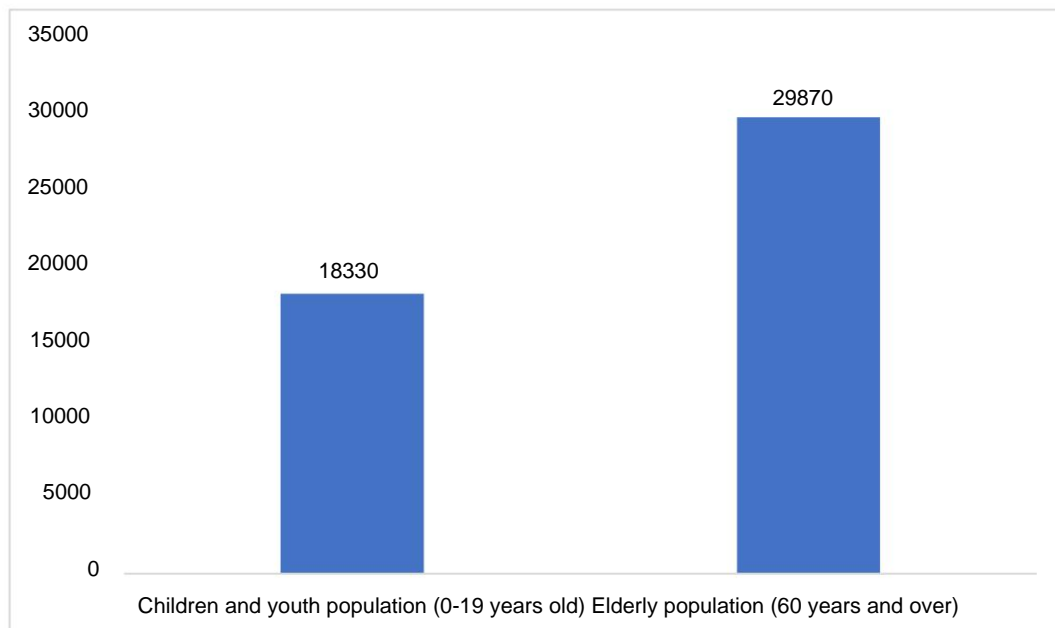


Table 2 shows the number of deaths confirmed by COVID-19 in the target populations of this study. As shown, the amount of deaths in the child and youth population corresponded to 23 cases and in the elderly population to 6,063.

Table 2: Number of deaths from COVID-19 in the child and youth population (0-19 years old) and the elderly (60 years and over)

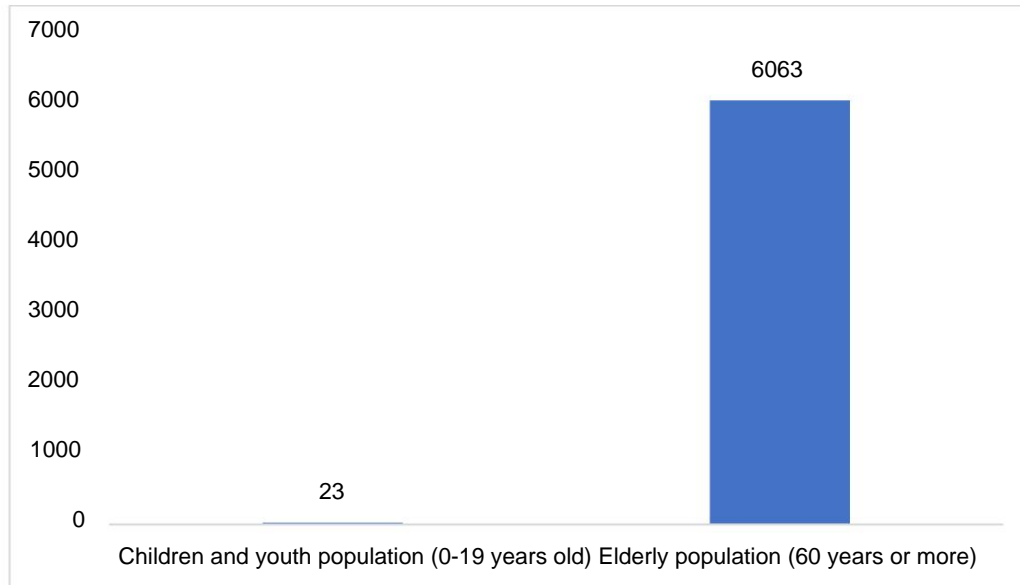
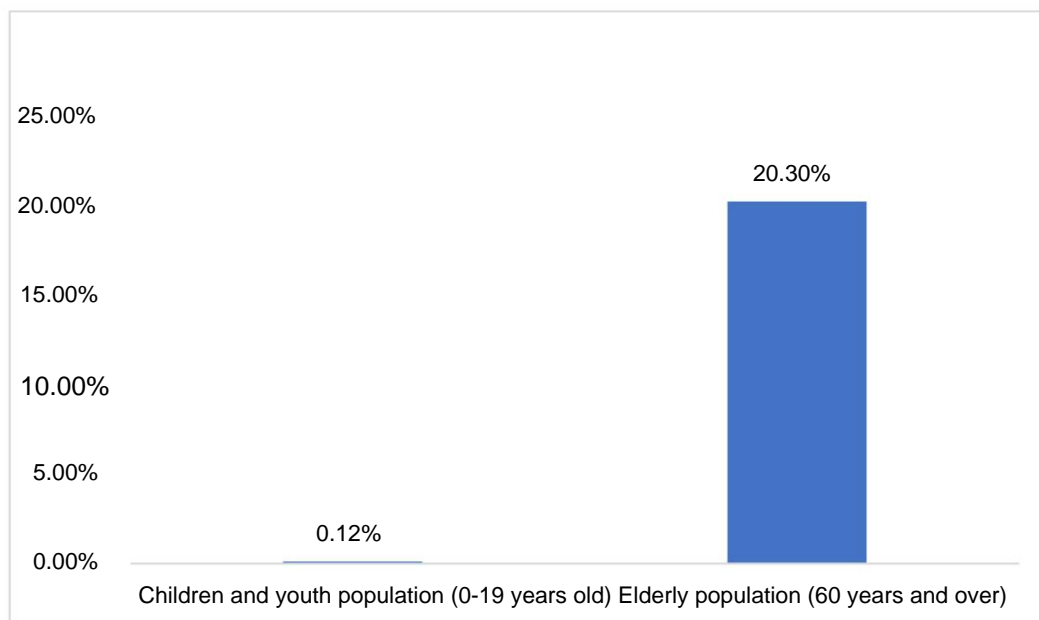


Table 3 shows the difference between the COVID-19 fatality rate in the child and youth population 0.12% and in the elderly 20.3%, a value approximately 169 times larger.

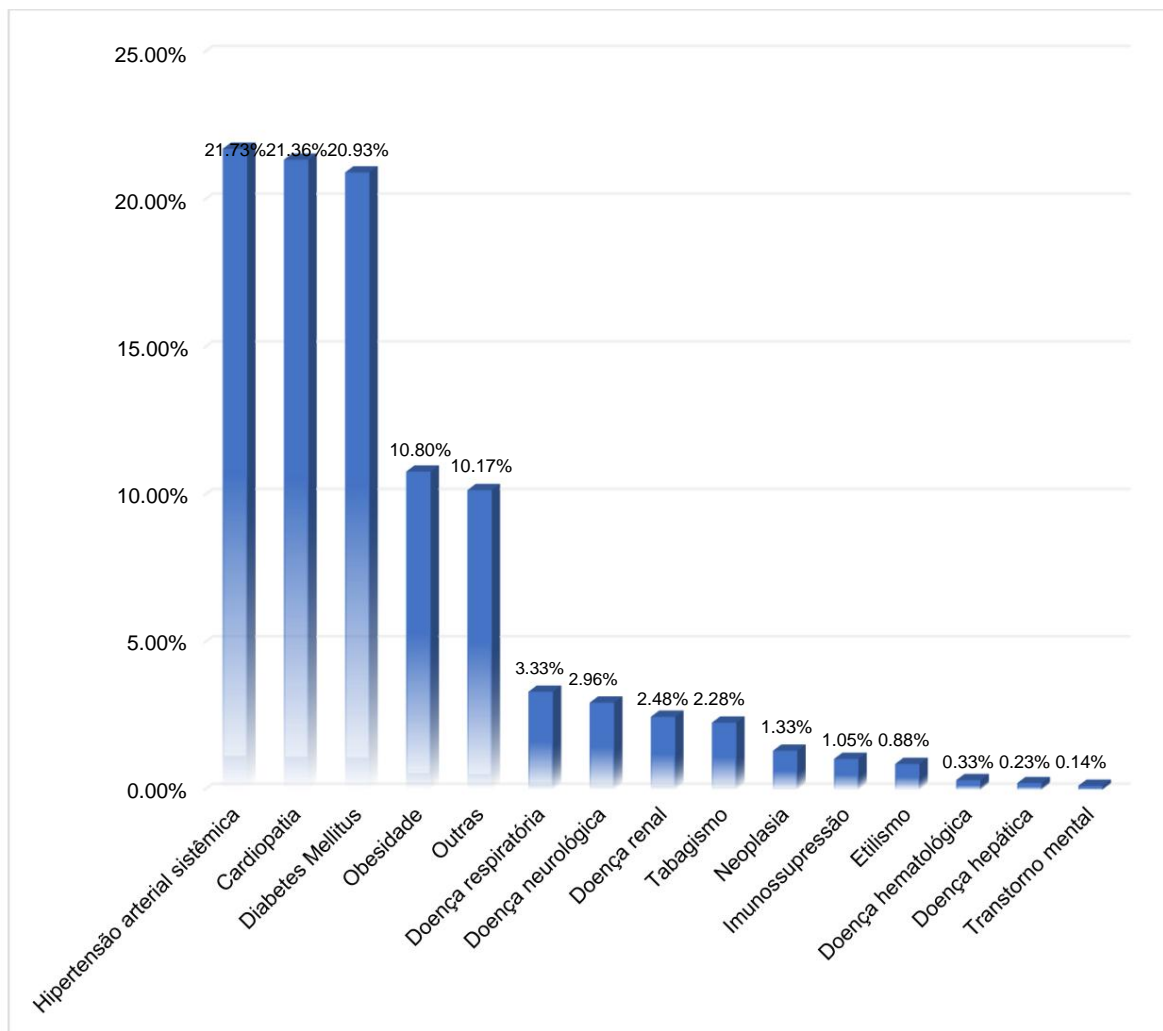
Table 3: COVID-19 fatality rate in the child and youth population (0-19 years old) and the elderly (60 years and over)



As can be seen in table 4, it is possible to state that the main comorbidities and risk factors related to manifestations

severe cases of COVID-19 in the elderly population were systemic arterial hypertension, heart disease, diabetes mellitus, obesity and other conditions that are divided between respiratory, neurological or renal disease, smoking, neoplasia, immunosuppression, alcoholism, hematological or liver disease and mental.

Table 4: Main comorbidities and risk factors related to serious manifestations of COVID-19



4. Discussion

Transmission of SARS-CoV-2 occurs mainly through contact with respiratory droplets from infected patients and the disease caused mainly affects the respiratory, cardiovascular, gastrointestinal and neurological. It can be presented in the form asymptomatic to severe forms with significant system impairment

respiratory. Its symptomatological pattern is mainly composed of fever, dry cough and dyspnea with the possibility of complications, especially pneumonia, severe acute respiratory syndrome (SARS) and death. It is a complex disease with little evidence of the best form of treatment (NUNES *et al.*, 2020).

Cases of severe acute respiratory syndrome (SARS) are defined by individuals who meet the following criteria: (a) fever, even if self-reported; (b) cough or sore throat; (c) dyspnea or O₂ saturation < 95% or respiratory distress; and (d) who have been hospitalized or died regardless of previous hospitalization (PAIVA *et al.*, 2020).

The main findings of COVID-19 infection in children after analyzes carried out are as follows: first, SARS-CoV-2 was susceptible to all age groups of children, with the majority of manifestations clinics fever, cough, nausea, vomiting and diarrhea and most of them had asymptomatic experience, with mild and moderate symptoms; second, the children were more likely to have normal white blood cell counts, while lymphocytosis occurred infrequently; third, the incidence of disease critical and vomiting symptoms were higher in children under 1 year of age deity. Children's clinical symptoms are often atypical when compared to adults (WANG *et al.*, 2020).

Systematic review aiming to analyze the frequency of children contaminated by COVID-19 found a low prevalence of contamination in group, when compared to young and elderly adults. Furthermore, the authors found that mild to moderate symptoms predominated, with little or no need for hospitalization for intensive care (GONÇALVES *et al.*, 2020).

Although more severe cases of SARS-CoV-2 infection, complications and high mortality rates have been reported around the world, children probably tend to have milder symptoms and a better prognosis than other age groups. In studies carried out with information obtained from COVID-19 infection in children, it was found It is clear that they have a greater tendency to present asymptomatic conditions and symptomatic with fever, cough, pneumonia, dyspnea/tachypnea, congestion

nose, nasopharyngeal erythema and sore throat, rhinorrhea, vomiting, diarrhea and pain abdominal pain, headache and fatigue and cases with ground-glass opacity on examinations of image. The rates of serious infection and need for hospitalization in children proved to be low (DING; YAN; GUO, 2020).

As was the case in Paraíba, the frequency of serious illness was relatively lower in children with COVID-19 when compared to adults. A possible explanation for this fact could be that children are less likely to have underlying conditions such as diabetes, hypertension or cardiovascular diseases. Furthermore, the fact that the innate immune response declines with age may also be important for this difference observed. Most documented cases of infection in children were arising from interfamily contagion (DING; YAN; GUO, 2020; WANG *et al.*, 2020).

Systematic review highlighted that comorbidities are an important factor to the poor prognosis (ARRUDA *et al.*, 2020) and this statement, associated with study also carried out in Paraíba (SOUSA; ESTRELA; BEZERRA, 2020) congregate that advanced age and comorbidities are risk factors for deaths from SARS-CoV-2.

CT manifestations of COVID-19 in pediatric patients are diverse and related to the severity of the disease or clinical classification. The most frequently identified image pattern in children is normal, with cases of ground-glass opacity on tomography exams computerized (CT) being occasional. This fact is not observed in the population adult, in which this opaque finding is the most frequently identified. That can be justified by the fact that mild and moderate symptoms are more common in the pediatric population. However, in children who presented change in the imaging examination, the ground-glass opacity pattern was the most common (DING; YAN; GUO, 2020; LI *et al.*, 2020; WANG *et al.*, 2020).

Abnormal CT images were less common in children with COVID-19. 19 than in adults, but imaging findings may be similar in kids and adults. Unilateral pneumonia is common in children with COVID-19. 19, and the main change in the image is the opacity in ground glass. However, bilateral pneumonia is more common in adults, and the main change in image is also opacity in ground glass. Thus, lung inflammation

in children it is usually moderate and localized. Furthermore, the results of laboratory tests of children infected with the new coronavirus are more often within the normal range than those of adults (GONÇALVES *et al.*, 2020; LI *et al.*, 2020).

Laboratory tests that must be analyzed and may present changes are blood count, liver enzymes (ALT and AST), creatinine and rate glomerular filtration rate, cardiac function, inflammatory markers (CRP, procalcitonin and lactic dehydrogenase) and D-dimer. Changes that can be found are leukocytosis or leukopenia. In children, these tests tend to be within normal parameters, but in severe cases of infection may present changes (DING; YAN; GUO, 2020).

CK-MB levels may be elevated in most children, being one of the classic biomarkers of cardiotoxicity. It was observed that the CK-MB may be elevated more frequently in children younger than one year of age. These results suggest that greater attention be paid to possible myocardial injuries in children, especially those with less one year of life (DING; YAN; GUO, 2020).

In an observational study carried out, it was observed that the severity of disease in children under one year of age proved to be higher when compared to children of older age groups. These results suggest that greater attention should be paid to changes in disease activity in children under one year of age, and vomiting tends to be more common in children in this age group. Thus, it is possible to state that the proportion of babies who develop more severe cases of COVID-19 is greater when compared to older children and the symptoms of vomiting are most commonly presented (DING; YAN; GUO, 2020).

The pathophysiological mechanism by which SARS-CoV-2 infects and causes disease is through angiotensin-2 converting enzyme receptors (ACE2). This protein is widely expressed on the surface of epithelial pericytes and microvascular, which cross several organs, allowing both cell types become infected by the virus. The recruitment of immune cells to sites of infection results in widespread inflammation and dysfunction endothelial in the lung, heart, kidney and liver and brain, with endotheliitis prominent of submucosal vessels and apoptotic bodies. The infection by

SARSCoV-2 can trigger a multisystem inflammatory response, inflammation and endothelial dysfunction through the endothelium-converting enzyme angiotensin-2 (ACE2) (DING; YAN; GUO, 2020; JIAO *et al.*, 2020; LEE *et al.*, 2020; CHEN *et al.*, 2021).

Even if viral loads decrease in the patient, a type of cytokine release can develop rapidly, characterized by disseminated intravascular coagulation (DIC), causing liver damage, renal dysfunction, cardiovascular inflammation, coagulopathy and death. Children and adults have different immune systems. The most immunological responses Children's weaknesses can prevent the destruction caused by immune responses induced by viruses (DING; YAN; GUO, 2020; DONG *et al.*, 2020).

Children are vulnerable to many viral infections, and they can establish innate immune responses when infected with respiratory viruses and other RNA viruses, which are associated with innate immune evasion. Lymphopenia may be related to the severity of COVID-19 and children (especially very young children) with an immature immune system and different immune responses have a low possibility of having lymphopenia (DING; YAN; GUO, 2020; DONG *et al.*, 2020).

Fever and cough are the two most common clinical manifestations presented by children and adults, while dyspnea seems to be less common in children. Pediatric patients are more likely to show upper respiratory symptoms such as sore throat, pharyngeal congestion and rhinorrhea. In contrast to adult patients, only a small number of children with COVID-19 have abnormal laboratory results, and most predominant findings are leukopenia/lymphopenia and increased creatine kinase rather than increased inflammatory markers (e.g., DHL, erythrocyte sedimentation rate and C-reactive protein) as observed in adults (DING; YAN; GUO, 2020; JIAO *et al.*, 2020; LEE *et al.*, 2020).

Approximately 20% of adult patients require care intensive, and 13.9% have fatal results. On the other hand, children with COVID-19 rarely have severe or critical illness, and the number of deaths among this group is low. However, children with underlying illnesses still have an increased risk of developing a serious illness. As such, This subgroup of children must receive specific care from their

families and health professionals (JIAO *et al.*, 2020; LEE *et al.*, 2020; RIPHAGEN *et al.*, 2020; SINHA *et al.*, 2020).

The reasons why children don't develop serious illness when compared to adults and are less susceptible to infection by COVID-19 and have milder symptoms than adults may include difference between the immune systems of these two groups. The answers Children's weaker immune systems can prevent the destruction caused by virus-induced immune responses. Children are vulnerable to many viral infections, and they can establish innate immune responses when infected with respiratory viruses and other RNA viruses, which are associated to innate immune evasion. Furthermore, several viruses simultaneously invading the airways and lung mucosa can competitively inhibit SARS-CoV-2 (DONG *et al.*, 2020; RIPHAGEN *et al.*, 2020; SINHA *et al.*, 2020).

SARSCoV-2 infection can trigger an inflammatory response systemic inflammation and endothelial dysfunction through the endothelium via receptors ACE2, in addition to increasing the possibility of developing the disease similar to Kawasaki disease, the multisystem inflammatory syndrome pediatric, due to a disorder in the inflammatory response to infection. In comparison with Kawasaki disease and other inflammatory diseases pediatric patients, children with pediatric multisystem inflammatory syndrome are older and present lymphopenia and more dominant elevation of markers inflammatory (DING; YAN; GUO, 2020; JIAO *et al.*, 2020; LEE *et al.*, 2020; CHEN *et al.*, 2021).

The most common symptoms in pediatric patients when infected with COVID-19 is fever, respiratory and digestive symptoms such as vomiting, nausea and diarrhea or fatigue, tachycardia, tachypnea, signs of pneumonia, pharyngeal erythema, nasal symptoms, upper air tract infections, laboratory of normal, decreased or increased white cell counts lymphocytes and elevation of C-reactive protein, in addition to changes in blood tests chest X-ray. The clinical spectrum of COVID-19 infection in children can vary from asymptomatic, in which there are no symptoms and signs clinical results, with normal chest imaging results, while the acid test nucleic acid is positive (DONG *et al.*, 2020; LEE *et al.*, 2020; JIAO *et al.*, 2020; SOUZA *et al.*, 2020).

Mild cases, with symptoms of acute upper respiratory tract infection, including fever, fatigue, myalgia, cough, sore throat, runny nose and sneezing. Exam physical examination showing pharyngeal congestion and normal auscultation. Some cases may not have a fever or just digestive symptoms, such as nausea, vomiting, abdominal pain and diarrhea. Moderate cases with pneumonia, fever frequent and coughing (mainly dry cough, followed by productive cough); some may have wheezing but no obvious hypoxemia, such as shortness of breath and when auscultating the lungs there may be rales or dry snoring and/or humid. Some cases may not have clinical signs and symptoms, but in computed tomography of the chest, lung lesions can be found, which are subclinical (DONG *et al.*, 2020; RIPHAGEN *et al.*, 2020; SINHA *et al.*, 2020; SOUZA *et al.*, 2020).

While severe cases of infection present with symptoms early respiratory symptoms, such as fever and cough, which may be accompanied by gastrointestinal symptoms, such as diarrhea. The disease usually progresses in 1 week, and dyspnea occurs with cyanosis. Oxygen saturation is around 92% with other manifestations of hypoxia, such as cyanosis, syncope, decreased level of consciousness and drowsiness. In critical cases the Children can quickly progress to severe acute respiratory syndrome or respiratory failure and also have shock, encephalopathy, myocardial injury or heart failure, coagulation dysfunction and acute kidney injury. In addition Furthermore, organic dysfunction can pose a serious risk to life (DONG *et al.*, 2020; RIPHAGEN *et al.*, 2020; SINHA *et al.*, 2020; SOUZA *et al.*, 2020).

On the other hand, high lethality from SARS-CoV-2 have been, at their greatest part, associated with elderly patients or the presence of more common comorbidities. common in these patients, being more than a fifth of those affected with more than 80 years, both in China and Italy. The COVID-19 pandemic constitutes a challenge for long-term care institutions for the elderly, given the belonging of institutionalized people to groups most susceptible to COVID-19 in its most serious forms, which can lead to worse outcomes clinical conditions, including death (MACHADO *et al.*, 2020).

In older patients, the presence of multiple problems chronic health conditions appear to be interrelated with the pathogenesis of COVID-19, a fact also observed in previous epidemics caused by other coronaviruses

(MERS and SARS). Although the clinical evolution is unclear, studies have demonstrated a direct and important relationship between the patient's age group and their burden of morbidities (number and severity) with increased risk for incidence of unfavorable clinical outcomes, such as hospital admission, need for intensive care unit (ICU) and death. These factors associated with low lymphocyte counts and high levels of lactate dehydrogenase upon hospital admission were important and independent risk factors for unfavorable clinical progression in these patients (NUNES *et al.*, 2020).

Approximately 72% of patients admitted to ICU due to COVID-19 had previous chronic diseases compared to those who did not require this intensive care (37%). A meta-analysis with eight studies and data from more than 46 thousand Chinese patients showed that diseases such as hypertension (17%), diabetes (8%), cardiovascular diseases (5%) and chronic respiratory diseases (2%) were the most common morbidities and with increased risk of developing a more serious course of SARS infection-CoV-2. In a complementary meta-analysis, it was observed that patients with previous diseases of the cardiovascular system presented a higher risk of forms severe cases of COVID-19 (NUNES *et al.*, 2020; O'DRISCOLL *et al.*, 2020).

Social determinants of health such as male sex and advanced age appear to be associated with mortality among hospitalized patients with COVID-19. Death is twice as likely in patients with any morbidity compared to those without disease. A study with 72,314 cases, from the China Center for Disease Control and Prevention, showed high mortality rate in patients with pre-existing morbidities: cardiovascular disease (10.5%), diabetes (7.3%), chronic respiratory disease (6.3%), hypertension (6%) and cancer (5.6%). Studies carried out with patients from China and Italy observed that the presence of any of the morbidities previously reported was associated with a 2.4 times higher risk of mortality (NUNES *et al.*, 2020).

In Brazil, the pandemic is more severe as the country has a high transmission rate, being the Latin American nation with the highest number of confirmed cases and deaths. Furthermore, there is concern among global health authorities in relation to the impact of the COVID-19 pandemic in middle and low-income countries due to the weaknesses of their

health systems, reduced availability of intensive care beds, limited number of mechanical ventilators and the prevalence of morbidities/infection (NUNES *et al.*, 2020; PAIVA *et al.*, 2020).

Allied to this context, the accelerated aging process in Brazil has occurred in a scenario of important magnitude and impact of diseases chronic and infectious diseases, in addition to marked socioeconomic inequities. Therefore, knowing the number of people at risk of severe COVID-19 can subsidize prevention actions (when a vaccine is available, for example example) and increase the intensity of non-pharmacological strategies to greater protection of individuals at high risk (NUNES *et al.*, 2020; PAIVA *et al.*, 2020; CHEN *et al.*, 2021).

The simultaneous occurrence of two or more morbidities considered to be risk for COVID-19 were associated with unfavorable outcomes for patients. The following morbidities were selected: diseases cardiovascular diseases (hypertension, stroke, acute heart attack myocardial disease, angina and heart failure), chronic kidney disease, chronic neurological disease (Alzheimer's disease and Parkinson's disease), chronic respiratory disease (emphysema, chronic obstructive pulmonary disease and bronchitis – measures together on the same question), diabetes, arthritis, asthma, cancer, depression and obesity. The presence of Cardiovascular Disease (CVD) in individuals infected with COVID-19 may result in a worse prognosis, in addition to being associated with a higher fatality rate. (NUNES *et al.*, 2020; O'DRISCOLL *et al.*, 2020; PAIVA *et al.*, 2020; ROMERO *et al.*, 2021).

In the elderly, indicators of the severity of the health situation: self-assessment of poor/very poor health status, frailty and report of any Difficulty performing basic activities of daily living (BADL) may be related to worse outcomes. The BADLs considered were: crossing room or walking from one room to another, dressing, bathing, eating, get in or out of bed and use the bathroom. Approximately 34 million Brazilians aged = 50 years have = 1 morbidity risk for severe COVID-19. It is possible to observe an increase in the prevalence of multimorbidity with advancing age, regardless of the region in Brazil (BATISTA *et al.*, 2020; NUNES *et al.*, 2020; ROMERO *et al.*, 2021).

In a cross-sectional study carried out in Brazil, among women, most prevalent morbidities are cardiovascular diseases, obesity, arthritis and depression. In epidemiological matters, it was observed that having at least one of the risk morbidities for severe COVID-19 is more prevalent among women in the Southeast Region (89.5%) and lower in the Northeast Region (84.1%). The South region has the highest prevalence of cardiovascular diseases (63.3%); the Southeast registered a higher prevalence of obesity (48.6%) and depression (36.1%) and the North Region showed the highest prevalence of arthritis (37.7%) among the women. The prevalence of one or more risk morbidities for COVID-19 severe was 86.4% for women and 74.3% for men. Have one or more of the risk morbidities for severe COVID-19 were more prevalent among women in the Southeast Region (89.5%) and lower in the Central-West Region (81.6%) (BATISTA *et al.*, 2020; NUNES *et al.*, 2020; ROMERO *et al.*, 2021).

Regarding multimorbidity, a higher prevalence was observed in women (59.4%), being more prevalent in the South Region (67%), among men, the prevalence of multimorbidity was 43.5%, with a higher prevalence in the Southeast Region (47.3%). Among men, the most prevalent morbidities were cardiovascular diseases, obesity, diabetes and arthritis. The biggest prevalence of cardiovascular diseases (54.1%) and obesity (36%) was observed in the Central-West Region, and diabetes (16.7%) and arthritis (15.4%) were more prevalent among men in the North Region. This combination of different health problems tend to create inflammatory processes, increasing susceptibility to different health problems, including acute infectious diseases (BATISTA *et al.*, 2020; NUNES *et al.*, 2020; PAIVA *et al.*, 2020; ROMERO *et al.*, 2021).

The most prevalent morbidities in Brazil related to COVID-19 severe among individuals aged = 50 years were the diseases cardiovascular diseases (56%), obesity (39%), arthritis (21%) and depression (18.5%), with little variation between regions of the country. When stratified by age, the most prevalent morbidities at all ages were diseases cardiovascular disease and obesity. In relation to sex, women presented the highest prevalence of individual morbidities in relation to men, except for cancer. It is important to know the biological mechanism that increases the risk of infections among people with multimorbidity, which appears to be

associated with increased inflammation and decreased responsiveness of the body's immune system (BATISTA *et al.*, 2020; NUNES *et al.*, 2020; PAIVA *et al.*, 2020; ROMERO *et al.*, 2021).

In this context, the Unified Health System (SUS) and primary care for health, through the coordination of care by the Health Strategy of Family, play a relevant role in alleviating social inequities in health through the prevention of virus infection and the management of conditions chronic diseases and multimorbidity during and after the pandemic, protecting especially the poorest population (BATISTA *et al.*, 2020; NUNES *et al.*, 2020; ROMERO *et al.*, 2021).

Health inequalities in Brazil can be observed in differences in the prevalence of chronic conditions and multimorbidity, in access and use of health services, and quality of life. Multimorbidity is more prevalent in women, the elderly, people with less education and unemployed. Furthermore, despite advances in access and use of services of health among the Brazilian population, important social and geographic inequalities (BATISTA *et al.*, 2020; NUNES *et al.*, 2020; ROMERO *et al.*, 2021).

The use of health services is directly associated with characteristics individual needs, such as higher education and having health insurance. Although present Before the pandemic, health inequalities could increase with the presence of COVID-19, generate risks of different outcomes when contracting the disease and worsening of the condition in individuals with the same level of morbidity. Taking into account the low-income conditions of many of the elderly population in Brazil, the risk of falling into poverty, due to the loss of income home care, as well as insufficient pensions to support living standards, force older people to continue working, even after retirement, or to make family arrangements to maintain minimally decent living conditions (BATISTA *et al.*, 2020; NUNES *et al.*, 2020; LAGE *et al.*, 2021; ROMERO *et al.*, 2021).

Severe forms of COVID-19 are more likely to develop in older people and those with diseases previous chronicles. In this sense, the occurrence of multimorbidity, that is, the presence of two or more chronic morbidities, is an important risk factor

to be considered, as, in itself, it is a predictor of risk of death. It is estimated that 67.8% of Brazilians over 50 years old live with multimorbidity.

Multimorbidity and COVID-19 have an important relationship with health inequities, so that individuals with worse socioeconomic conditions tend to be most affected. Furthermore, feelings of loneliness due to the distance from friends and family in the pandemic can trigger anxious symptoms and depression in the elderly (BATISTA *et al.*, 2020; LAGE *et al.*, 2021; ROMERO *et al.*, 2021).

In this sense, the benefits of physical activity in reducing depressive symptom scores in older adults are well documented. In fact, the practice of physical activity and physical exercise can reduce rates of anxiety and depression by triggering the release of endorphin, dopamine and serotonin, neurotransmitters involved in the response body to stress, which could help older individuals to remain more stable during demanding extrinsic situations, such as current pandemic situation (LAGE *et al.*, 2021).

5. Final Considerations

According to the findings, a higher mortality rate was observed due to COVID-19 in the elderly population when compared to children. However, the SARS-CoV-2 was susceptible to all child and adolescent age groups.

The occurrence of multiple morbidities may be associated with the risk of development of clinically serious forms of COVID-19. Illnesses cardiovascular disease and obesity are the most frequent conditions regardless of sex. The main comorbidities related to more severe forms of COVID-19 infection in elderly patients are hypertension, stroke, acute myocardial infarction, angina, heart failure, chronic kidney disease, Alzheimer's disease, Parkinson's, chronic obstructive pulmonary disease, emphysema or chronic bronchitis, diabetes, arthritis, asthma, cancer, depression and obesity.

Finally, it can be stated that knowledge of the epidemiology of multimorbidity related to COVID-19, especially in the elderly, can represent an important step towards defining strategies and tools

for the care of the population with accumulated risks, both from the point of view demographic, socioeconomic and health status. The presence of disease cardiovascular disease (CVD) in individuals infected with COVID-19 may result in a worse prognosis, in addition to being associated with a higher mortality rate.

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