REME • Rev Min Enferm. 2023;27:e-1531
DOI: 10.35699/2316-9389.2023.40517

RESEARCH

RACE/SKIN COLOR AND COVID-19 MORBIDITY AND MORTALITY IN THE STATE OF *SÃO PAULO* - SP

RAÇA/COR DA PELE E MORBIMORTALIDADE POR COVID-19 NO ESTADO DE SÃO PAULO - SP

RAZA/COLOR DE PIEL Y MORBIMORTALIDAD POR COVID-19 EN EL ESTADO DE SÃO PAULO - SP

Jade Alycia Ribeiro e Santos[1]
Sílvia Carla da Silva André Uehara[2]
Ana Paula Vechi Corrêa[3]

[1]Universidade Federal de Minas Gerais - UFMG, Escola de Enfermagem. Belo Horizonte, MG - Brazil.

[2]Universidade Federal de São Carlos - UFSCar, Departamento de Enfermagem, Professora Adjunta II. São Carlos, SP - Brazil.

[3]Universidade Federal de São Carlos - UFSCar, Departamento de Enfermagem, Programa de Pós-Graduação em Enfermagem. São Carlos, SP - Brazil.

Corresponding author: Jade Alycia Ribeiro e Santos

E-mail: jadealycia23@gmail.com

Authors' Contributions:

Conceptualization: *Sílvia C. S. A. Uehara; Data Collection: Jade A. R. Santos;* **Funding Acquisition:** *Sílvia C. S. A. Uehara, Jade A. R. Santos;* **Investigation**: *Jade A. R. Santos; Methodology: Sílvia C. S. A. Uehara;* **Project Management:** *Síl-via C. S. A. Uehara;* **Resource Management:** *Jade A. R. Santos, Sílvia C. S. A. Uehara; Statistical Analysis: Jade A. R. Santos;* **Supervision:** *Sílvia C. S. A. Uehara;* **Validation:** *Síl-via C. S. A. Uehara;* **Visualization:** *Jade A. R. Santos;* **Writing – Original Draft:** *Jade A. R. Santos, Ana P. V. Corrêa;* **Writing – Revision and Editing:** *Sílvia C. S. A. Uehara, Jade A. R. Santos.*

Funding: Scientific initiation scholarship granted by the *Amparo à Pesquisa do Estado de São Paulo* (FAPESP - the *São Paulo* State Foundation for Research Support), process 2021/08456-0.

Submitted: 18/07/2022
Approved: 27/10/2023

Editors Responsible:
Alexandra Dias Moreira
Luciana Regina Ferreira da Mata

ABSTRACT

Objective: to analyze the relationship between ethnicity/skin color and morbi-mortality from COVID-19 in the state of *São Paulo - SP*. **Methods**: ecological, retrospective, and analytical study, whose data were collected from the State Data Analysis System (SEADE) of the Government of the State of *São Paulo*, covering from February 2020 to September 2021. Data analysis used a regression model with multiple binomial negative distribution, to compare the incidence and mortality specific between ethnicities/skin colors. **Results**: a comparison between the incidence curves of COVID-19 showed a significant statistical difference between all groups of ethnicity/skin color. In the comparison of trends between white and brown, the result was $p = 0.007$; in the comparison of trends between white and black, it was $p = 0.001$; in the comparison of trends between brown and black, $p = 0.003$. However, when we compare the trends of incidence per sex and age group with death trends, there was no statistical difference. **Conclusion**: ethnicity/skin color has influenced general incidence curves by COVID-19 in *São Paulo*. The fact that it was not associated with mortality can be related with the lack of information about ethnicity/color in notification forms, thus affecting the availability of such data in information systems, which reiterates the importance of publicizing quality official epidemiological data.

Keywords: Indicators of Morbidity and Mortality; Racial Groups; Coronavirus; COVID-19; Epidemiology.

RESUMO

Objetivo: *analisar a relação entre a raça/cor da pele e a morbimortalidade por COVID-19 no estado de São Paulo-SP.* ***Métodos***: *estudo ecológico, retrospectivo e analítico, cujos dados foram coletados no Sistema Estadual de Análise de Dados (SEADE) do Governo do Estado de São Paulo e correspondem ao período de fevereiro de 2020 a setembro de 2021. Na análise de dados, utilizou-se o modelo de regressão com distribuição binomial-negativa múltipla, para comparar a incidência e a mortalidade específica entre as raças/cores de pele.* ***Resultados***: *ao se compararem as curvas de incidência de COVID-19, houve diferença estatística significativa entre as comparações de todos os grupos de raça/cor da pele. Na comparação entre tendências branca vs parda, o resultado foi p = 0,007; na comparação entre tendências branca vs preta, p = <0,001; na comparação entre tendências parda vs preta, p = 0,003. Porém, quando foram comparadas as tendências de incidência por sexo e faixa etária e as tendências de óbito, não houve diferença estatística.* ***Conclusão***: *a raça/cor da pele influenciou nas curvas de incidência geral por COVID-19 no estado de São Paulo, porém a não associação com a mortalidade pode estar relacionada com a falta de informação sobre raça/cor/etnia nas fichas de notificação, afetando consequentemente sua disponibilidade nos sistemas de informação, o que reforça a importância da divulgação de dados epidemiológicos oficiais de qualidade.*

Palavras-chave: *Indicadores de Morbimortalidade; Grupos Raciais; Coronavírus; COVID-19; Epidemiologia.*

RESUMEN

Objetivo: *analizar la relación entre la raza/color de piel y la morbimortalidad por Covid-19 en el estado de São Paulo-SP.* ***Métodos***: *estudio ecológico, retrospectivo y analítico, cuyos datos fueron recolectados en el Sistema Estatal de Análisis de Datos (SEADE) del Gobierno del Estado de São Paulo y corresponden al período de febrero de 2020 a septiembre de 2021. Para el análisis de datos se utilizó el modelo de regresión con distribución binomial-negativa múltiple para comparar la incidencia y la mortalidad específica entre las razas/colores de piel.* ***Resultados***: *al comparar las curvas de incidencia de Covid-19, hubo una diferencia estadística significativa entre las comparaciones de todos los grupos de raza/color de piel, siendo que en la comparación entre tendencias blanca vs parda p= 0,007; comparación entre tendencias blanca vs negra p= <0,001; comparación entre tendencias parda vs negra p= 0,003. Sin embargo, cuando se compararon las tendencias de incidencia por sexo y grupo etario y las tendencias de muerte, no hubo diferencia estadística.* ***Conclusión***: *la raza/color de piel influyó en las curvas de incidencia general por Covid-19 en el estado de São Paulo, sin embargo, la no-asociación con la mortalidad puede estar relacionada con la falta de información sobre raza/color/etnia en las fichas de notificación, y consecuentemente su disponibilidad en los sistemas de información, reforzando la importancia de la divulgación de datos epidemiológicos oficiales de calidad.*

Palabras clave: *Indicadores de Morbimortalidad; Grupos Raciales; Coronavirus; COVID-19; Epidemiología.*

How to cite this article:
Santos JAR, Uehara SCSA, Corrêa APV. Race/skin color and COVID-19 morbidity and mortality in the state of *São Paulo*. REME - Rev Min Enferm. 2023[cited _____ ___ __];27:e-1531. Available from: https://doi.org/10.35699/2316-9389.2023.40517

INTRODUCTION

The COVID-19 pandemic started in Wuhan, China, in December 2019 and became a serious public health issue that rapidly spread around the world. Up to December 2021, the Coronavirus Disease 2019 (COVID-19), caused by the SARS-CoV-2 virus, had already affected more than 210 countries and territories[1,2].

Despite the adoption of non-pharmacological measures to contain the disease, and the advance of vaccination against COVID-19, Brazil, where the outbreak started in February 2020, was one of the main epicenters of the pandemic. At time of writing, the country has had more than 32 million confirmed cases and 670,000 deaths caused by the disease[3].

Among Brazilian states, *São Paulo* stands out as the one with the highest number of cases and deaths on record since the virus started spreading throughout the country. Both the first official case in Brazil and the first notification of death by COVID-19 took place in the capital of *São Paulo*, less than one month apart[4]. By mid-2022, the state housed 17% of cases and 25% of national deaths [3].

The dynamics of COVID-19 transcend biology and health, being strongly related to economic, political and social issues[5]. Studies have shown that the socioeconomic context is a determining factor for cases to progress into deaths by COVID-19, and the fact that most individuals infected have a race/skin color which has been historically stigmatized or belong to more vulnerable population groups shows the undemocratic nature of the disease[5,6].

From this perspective emerges a reflection about the discrepancies in the risk of infection and death by COVID-19 in the different ethnic and racial groups. A study from August 2020, to characterize the mortality by COVID-19 in Brazilian hospitals, used information from the Influenza Epidemiological Surveillance Information System (SIVEP-Gripe) to point out that being "brown" was the second most important characteristic, after age, for death due to COVID-19 infections[7].

In Brazil, during the early days of the pandemic, incidence coefficients were higher in the white population[8]. However, as the pandemic advanced, the ones most affected by it were black individuals, which were the most likely to be hospitalized due to Severe Acute Respiratory Syndromes (SARS) and die by COVID-19[8]. When compared with white people, black and brown individuals were more likely to die, since they used hospital resources less often, such as Intensive Care Unit (ICU) beds and respiratory support, manifesting more severe clinical conditions[9].

Therefore, studies that determine how population life conditions interfere in the treatment of COVID-19 and its lethality, focusing on social groups that were more vulnerable in the pandemic context, are essential for the needs of the members of these social strata to be given priority, so guidelines and interventions are adapted according to their demands, improving the effectiveness of treatment and, consequently, reducing mortality.

In the absence of studies on the epidemiological profile of the disease specific to the state of *São Paulo*, and considering the prominence of the state in the records of cases and deaths from COVID-19, this study aims to analyze the relationship between race/skin color and morbidity and mortality due to COVID-19 in *São Paulo*, considering that the variable race/color is a determining factor for infection and for the evolution of COVID-19 clinical conditions.

METHODS

This is an ecological, retrospective, and analytical study. Data to calculate the coefficient of incidence and mortality was collected from two databases, Available from the State Data Analysis System (SEADE)(10), on the website of the *São Paulo* state government. One of the databases had information on the date of symptom onset, while the other included data on race/color, both containing information for the period from February 2020 (when the first COVID-19 case in the state of São Paulo was confirmed) to September 2021. Furthermore, the total population, used as a denominator for calculating the coefficients, was found using the 2010 census of the Brazilian Institute of Geography and Statistics (IBGE) [11]. For methodological purposes, we decided to name the database with the date as "Base 1", and the one with information o race/skin color as "Base 2". In this study, we analyzed the demographic variables race/color, age, and sex.

At first, in Base 1, which contained data on the date of the onset of symptoms, there were 4,399,216 cases listed, while Base 2, which provided information on skin color, covered 4,399,007. Before we started, we had to verify both databases to exclude any records with no valid information on age, sex, death, obesity, diabetes, and heart disease, i.e., any records without such information were discarded. As a result, there were 183,635 records left in Base 1, with the dates, and 160,914 in Base 2, with skin color information. Thus, we only considered notifications

of records in which information regarding the variables analyzed was complete.

cLater, we used the software STATA to carry out a probabilistic record linkage in, considering the variables IBGE code, age, sex, death, obesity, diabetes, and heart disease. We only considered perfect pairs, that is, those where the variables had the same information as to age, sex, death, obesity, diabetes, and heart diseases in both databases, leaving 177,214 cases. In addition, we only selected unique pairings, meaning that, when more than one case presented the same information, we only considered one of them. This led to the exclusion of 23,668 other cases, which would have had presented more than one pairing. Furthermore, we excluded 434 cases from October 2021, as the information about them was incomplete. Thus, we included 153,112 cases in the study for analysis, resulting from a perfect and unique matching process and encompassing the following variables: IBGE code, age, sex, death, obesity, diabetes, heart disease, race/color, and date of the onset of symptoms.

The variable race/skin color was divided into three categories: white, brown, and black. We decided not to include Asian and native races/skin colors, as the numbers pertaining to them were too low, which would compromise the robustness of the statistical analysis.

To compare the race/skin colors regarding the monthly number of COVID-19 cases and deaths, we used a regression model with a multiple negative binomial distribution[12], since the response was an overdispersed observation (variance higher than the mean). In this model, we considered the main effects of interaction with time (from 1 to 20, representing the months of observation) and/or harmonic functions (based on sines and cosines to model peaks and troughs in the historical series). The interaction of interest variables with time allows comparing trends of incidence rates and mortality throughout a certain period. Furthermore, to estimate rates, we used an offset parameter of log(population/100000) for incidence rates and log(cases/100) for death rates. To control for potential confounding effects, variables with the number of cases of obesity, heart disease, and diabetes were inserted in the regression models for the outcomes, incidence rates, and mortality rates. In addition, the incidence coefficient was also considered to be a control variable.

All graphs and analyses presented were carried out with the help of the software R, version 4.0.4. For all analyses, we used a significance level of 5%. Additionally, the initial point of each graph marks the first month in which cases/deaths due to COVID-19 were recorded in the state according to the databases consulted, in addition to numbers referring to incidence and mortality rates.

This research used secondary data, and as such, did not need to be submitted for evaluation by the Research Ethics Committee, in accordance with Resolution No. 466/2012, by the National Health Council.

RESULTS

4,366,132 COVID-19 cases were reported in the period investigated (from February 2020 to September 2021). However, we only considered cases where all variables analyzed were thoroughly reported (containing valid information on age, sex, and death), and those which had a perfect and single pairing in the linkage of databases. Thus, our analysis included 153,112 confirmed cases of the disease in the state of *São Paulo*.

An analysis of the monthly COVID-19 incidence in the white, brown, and black populations showed that, although trend curves were similar during most of the period analyzed, the incidence from March to June 2020 was higher in brown and black persons, and, starting in July 2020, the incidence in the white population was higher than in the other population groups (Figure 1A).

In the second semester of 2020, from July to October, there was a decrease in incidence in all racial groups; starting in October, however, the number of infected once again started to progressively grow in all groups. Peaks of incidence for all groups were also found to take place from March to May 2021; also, from May to September 2021 there was a decrease in incidence for all racial groups (Figure 1A).

The incidence variation throughout the months, for both sexes, was similar. However, the incidence in black women was greater from March to July 2020. Later, from August 2020 to September 2021, the number of white and black women affected by the disease is similar, and higher than the number of brown women (Figures 1B and 1C).

In the age group from 0 to 19 years, from August 2020 to February 2021, the incidence was higher in the group of black people. In October 2020, it was higher among brown people. In the other periods, the incidence was greater in the white population. In age groups above 20, the incidence was similar in all groups analyzed. The group of 60-year-old or older persons stood out, as it presented a higher number of cases in black people throughout most of the period analyzed, with the exception of February, October, and November of 2020, and July of 2021 (Figures 1E, 1F and 1G).

As we compare the incidence curves of COVID-19, there was a significant difference in the comparison between all racial/skin color groups. In the comparison of trends between white and brown, the result was $p = 0.007$; in the comparison of trends between white and black, it was $p = 0.001$; in the comparison of trends between brown and black, $p = 0.003$. However, when we compare the incidence trends by sex and age group, there was no statistical difference (Table 1).

Regarding mortality from COVID-19, during most of the period analyzed, from March 2020 to September 2021, the mortality coefficients in all racial groups presented similar values; however, during the period of highest incidence of the disease, between February and June 2021, mortality was higher in the black population (Figure 2A).

At the start of the pandemic, in February 2020, a low number of deaths was recorded among brown and black individuals. This scenario changed in the following months, when mortality rates grew for these groups. From June to September 2020 and January to June 2021, mortality was higher in the black population (Figure 2A).

The analysis of mortality according to sex revealed that the coefficient of male deaths was high in the first months of the pandemic for all groups analyzed. Mortality trend curves were similar between all groups in both sexes; however, deaths among black persons were higher in a large portion of the period analyzed. Among males, from April to July 2020, and from January to July 2021, mortality was higher among black persons. Among females, mortality rates were higher among black women from June to September 2020 and from January to April 2021 (Figures 2B and 2C).

An analysis of the variation of mortality rates according to age group shows that they are higher in those above 60 years old for all racial groups. In the age group from 0 to 19 years old, the death rates were higher among white and brown persons in the first year; later, from January to April 2021, there was a significant increase in death rates among black persons (Figure 2D).

In the age groups from 20 to 39 and from 40 to 59, death rate trends in all racial groups were similar. However, at several points during the period analyzed, the number of deaths among brown and black people was higher than in white individuals. This difference is especially noticeable in the age group from 20 to 39 years old (Figures 2E and 2F).

Regarding the population above 60 years old, the number of deaths in the black population remained high for almost the entire period considered, except in the first months of the pandemic (Figure 2G).

Evaluating the risk of death in regard to race/skin color showed there is no statistical difference between the trends of death in white, brown, or black individuals. The same result was found when we correlated risk of death by sex and age group (Table 2).

Table 1: Comparison models between curves (white *vs* brown; white *vs* black; brown *vs* black) for the incidence of COVID-19 cases in the state of *São Paulo*, 2021

From Feb/2020 to Sept/2021	
Incidence of COVID-19 cases per 100,000 residents	*p-value*
General model*	
Comparison between the tendencies (white vs brown)	0.007
Comparison between the trends (white vs black)	<0.001
Comparison between trends (brown vs black)	0.003
Model per sex*	
Male	
Comparison between the tendencies (white vs brown)	0.441
Comparison between the trends (white vs black)	0.051
Comparison between trends (brown vs black)	0,826
Female	
Comparison between the tendencies (white vs brown)	0.518
Comparison between the trends (white vs black)	0.397
Comparison between trends (brown vs black)	0.998
Model per age group*	
0-19 years old	
Comparison between the tendencies (white vs brown)	0.999
Comparison between the trends (white vs black)	0.996
Comparison between trends (brown vs black)	0.973
20-39 years old	
Comparison between the tendencies (white vs brown)	0.946
Comparison between the trends (white vs black)	0.999
Comparison between trends (brown vs black)	0.999
40-59 years old	
Comparison between the tendencies (white vs brown)	0.376
Comparison between the trends (white vs black)	0.514
Comparison between trends (brown vs black)	0.999
60 years old or older	
Comparison between the tendencies (white vs brown)	0.999
Comparison between the trends (white vs black)	0.999
Comparison between trends (brown vs black)	0.999

*adjusted by number of obesity, heart disease, and diabetes cases
**regression model with multiple negative binomial distribution, $p = 0.05$.

Table 2: Comparison models between curves (white vs brown; white vs black; brown vs black) for deaths by COVID-19 in the state of *São Paulo*, 2021

From Feb/2020 to Sept/2021	
Specific mortality per 100 confirmed cases	***p*-value**
General model **	
Comparison between the tendencies (white vs brown)	0.477
Comparison between the trends (white vs black)	0.995
Comparison between trends (brown vs black)	0.709
Model with sex**	
Male	
Comparison between the tendencies (white vs brown)	0.967
Comparison between the trends (white vs black)	0.542
Comparison between trends (brown vs black)	0.772
Female	
Comparison between the tendencies (white vs brown)	0.992
Comparison between the trends (white vs black)	0.999
Comparison between trends (brown vs black)	0.988
Model with age group**	
0-19 years old	
Comparison between the tendencies (white vs brown)	0.999
Comparison between the trends (white vs black)	0.999
Comparison between trends (brown vs black)	0.922
20-39 years old	
Comparison between the tendencies (white vs brown)	0.999
Comparison between the trends (white vs black)	0.999
Comparison between trends (brown vs black)	0.999
40-59 years old	
Comparison between the tendencies (white vs brown)	0.883
Comparison between the trends (white vs black)	0.856
Comparison between trends (brown vs black)	0.999
60 years old or older	
Comparison between the tendencies (white vs brown)	0,359
Comparison between the trends (white vs black)	0.712
Comparison between trends (brown vs black)	0.999

*adjusted by incidence rate and number of cases of obesity, heart disease, and diabetes.
**regression model with multiple negative binomial distribution, $p = 0.05$.

DISCUSSION

The results of this study show that the incidence in white persons was higher in almost every period analyzed, and associations were identified between incidence trends and all races/skin colors; however, no correlation was found between the trends of death by COVID-19 and race/skin color. The pandemic increased health inequalities and the vulnerability that disproportionately affects black and brown persons, marked by a historical disadvantage in the context of Brazilian society.

It is noteworthy that the apparent higher incidence of COVID-19 in white people is related to the fact this population group has more access to diagnostic tests. In this context, we must consider that there are more obstacles for the black population to access health services. This was true even before the COVID-19 pandemic started. The difficulty of access by the black population is related to education and income levels, and also to social and economic factors that are determinant of life conditions[13].

The evolution of the pandemic increased individual, social, and programmatic vulnerabilities that have historically affected the black population[14]. Individual vulnerabilities involve biological, psychosocial, and attitudinal issues that are part of the health-disease process. Social vulnerability, in turn, is related to socioeconomic and cultural elements that dictate a population's access to goods and services. Finally, programmatic vulnerability is characterized by the social and institutional tools that an individual needs to ensure their physical and psychosocial well-being and integrity[14]. In general, this setting can be explained by considering institutional racism, which makes it difficult for the black population to access health services.

In this regard, it is clear that racism is one of the pillars of health inequities, which have been experienced by black people since these inequities became a reality. Institutional racism can be defined as a systemic process that ensures the selective exclusion of groups that have been historically subordinated due to race. It is characterized by organizational, political, and practical actions that not only cause the vulnerability and inequality of those victimized by racism, but also help maintain them[15].

In public health services, the population is subjected to long waiting lines to get specialized medical consultations and exams. However, the black population has less access to health insurance and, in most cases, depends exclusively on the Single Health System. Thus, this population is more affected by the long time it takes to carry out treatments, which also leads to increased risks and clinical repercussions of their health conditions, lack of medication, and lack of access to specialized services, in addition to subjecting them to moral abuse[16].

Furthermore, it was found that physical isolation in the beginning of the pandemic was impractical, which reflected on the incidence and mortality of the disease. This is associated with the socioeconomic situation of the black population, which is plagued by low quality housing, precarious access to basic sanitation, unstable

Figure 1: General monthly incidence of COVID-19 by sex and age group in the state of *São Paulo*, 2021

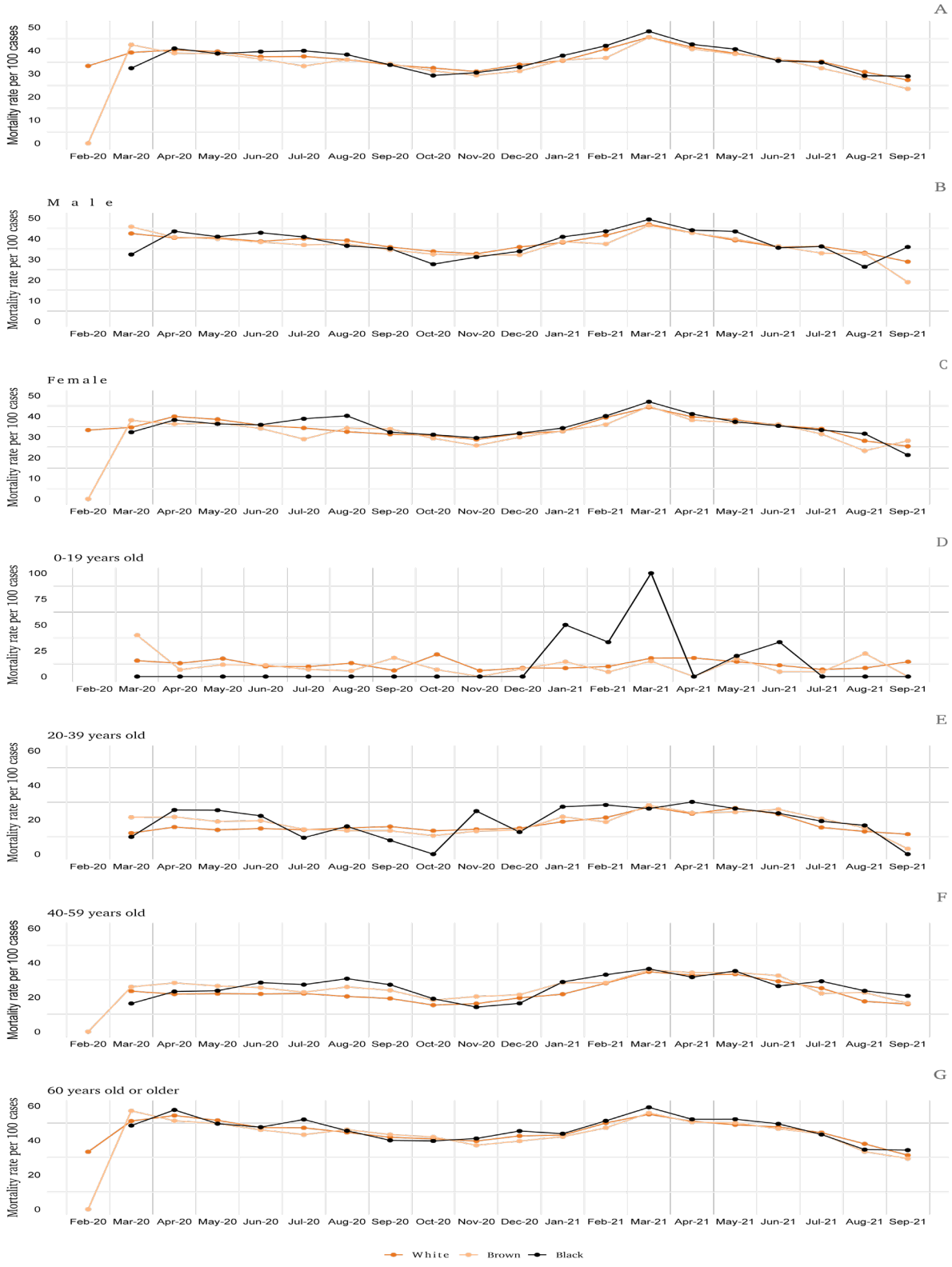
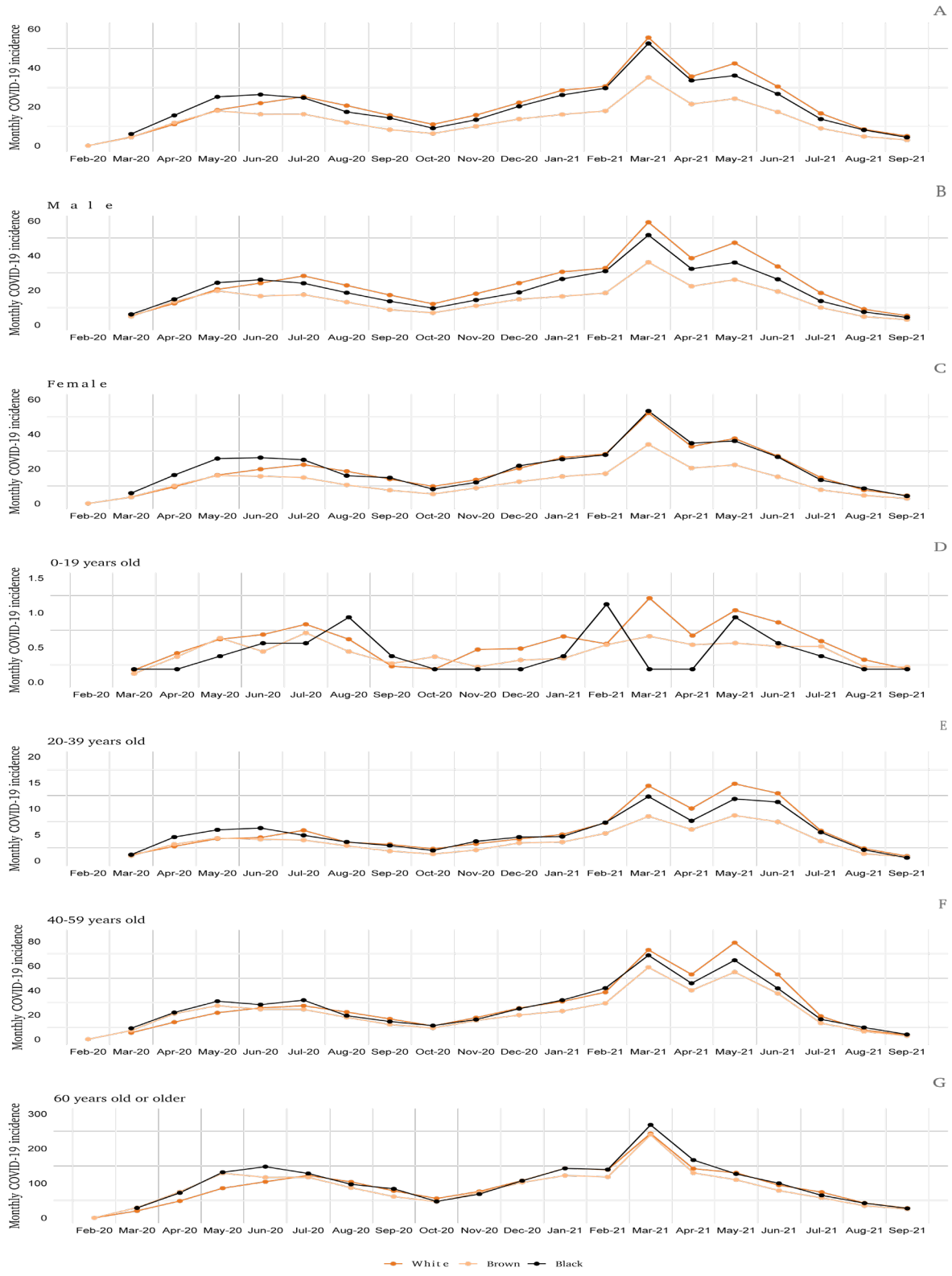


Figure 2: Mortality from COVID-19 per 100 cases – general, per sex, and per age group, in the state of *São Paulo*



employment, and a complete lack of job security[8]. Comorbidites such as systemic arterial hypertension (SAH) and diabetes also stand out as risk factors for the development of more severe COVID-19 cases which are prevalent in the non-white portions of the populace[8].

From this perspective, data from the Ministry of Health shows that black persons have been two to three times more affected by COVID-19 than white people. This analysis showed that, at the beginning of the pandemic, the number of hospitalizations was higher among white people, progressively decreasing over time. In black persons, hospitalization rates showed an increasing trend during the pandemic[17].

As for the incidence of COVID-19 according to sex, our study shows that the curves of cases are similar between men and women, which is also true for the prevalence of infections in white people. Similarly, a research in the northeast of Brazil showed that, in the states of *Paraíba, Alagoas, and Rio Grande do Norte*, case distribution was practically equal between the sexes[8]. However, in the other states of the region, it was found that most COVID-19 cases reported affected women, although death rates were higher among men[18]. This may be related with the "feminization of the health workforce", that is, to the fact that women, who occupy most of roles in the field of health, are in the front lines of the struggle against COVID-19 and, consequently, are more vulnerable to infection by the virus[19].

Regarding mortality by COVID-19, the study showed that, in the beginning of the pandemic, death rates were higher among white and brown persons; however, as the health crisis developed, from June to September 2020 and from January to June 2021, mortality was higher in the black population.

This is due to the fact that the first cases of the disease in the country were reported in the most privileged social classes, especially in the case of white people coming back from international trips[20]. Therefore, in the first month of the pandemic in Brazil, those who lived in poorer, predominantly non-white regions were less likely to be hospitalized due to the disease.

The exposure of the black population to the virus, thus, took place as they provided services in richer neighborhoods of their cities, where the number of infected people was higher. Still, during the first six weeks of the pandemic in Brazil, mortality was higher in white people, who, on average, represented 64% of deaths[20,21]. These pieces of data, however, should be taken with a grain of salt, since one must consider their relationship with the access to diagnostic tests and the massive number of underreported cases in Brazil.

At the beginning of the pandemic, the Brazilian government followed the testing protocol recommended by the World Health Organization, which recommended only testing symptomatic individuals, in addition to prioritizing people included in risk groups. This restricted testing scenario, when associated with the high costs of the diagnostic test, meant that the white population had more access to it, as they, historically, are more socioeconomically privileged. Thus, cases and deaths in the more vulnerable population segments, mostly formed by brown and black people, were undertested, and thus, underreported[22].

This underreporting takes place due to the fact that black and brown populations have trouble accessing health systems due to their lack of resources, to difficulties in accessing means of transportation, and to institutional barriers, since a significant number of these individuals live in places where public services take long to be implemented, when they are. The "dark areas" formed by underreported cases contribute for the erasure of the actual epidemiological situation of individuals in groups more vulnerable to COVID-19, and for their needs to be ignored in the context of the pandemic[22].

Our analysis of mortality according to sex shows that deaths among males have been higher since the first months of the pandemic for both ethnic groups, in addition to the fact that, in early 2020, deaths among women were less common. The fact that the numbers were more expressive in men can be explained when we consider the prevalence of comorbidities; the different immune responses between the sexes; the greater adoption of risk behaviors, such as smoking and drinking; and more exposure in the work environment[23].

This study found a higher mortality rate among black men from April to July 2020 and from January to July 2021. This result corroborates an analysis carried out in 2021, in which it was found that black men die more than white men due to differences in labor positions and inequalities in the access to resources, in addition to environmental factors[24].

Regarding the variation of mortality per age, this study corroborates an investigation developed with data from 16 countries, which showed that 60-year-old or older persons had a significantly higher death rate than younger people. The predominance of death in older persons can be explained by physiological phenomena and, especially, due to the fact that older people are more likely to be affected by chronic diseases[23,25].

Research indicates that the prevalence of chronic conditions in Brazil is higher among black older persons (78.6%) when compared to white (74.9%) or brown (72.9%) seniors. The population of black persons above 60 years has the worst health estimates than any other group in the older population[26]. As a result, all risk factors coexist in black older persons, meaning they are more susceptible to death by COVID-19.

Furthermore, the analysis of deaths by COVID-19 per age group showed that the economically active population was especially impacted by the consequences of the pandemic. An analysis of informal work, from the perspective of race/skin color, found that most people with informal, unregistered work, are black, while white people were in higher positions in the work market, having more job security[27].

This shows that black individuals carry out less secure jobs, often being outsourced and working in domestic service, as general service auxiliaries, bus drivers, application delivery workers, or clerks, in addition to being strongly inserted in the health sector[22]. This setting means that the black population is even more vulnerable to the disease, since their activities, seen as essential, make working at home impossible, exposing them to contamination in their way to their jobs and when at work[28].

The limitations of this study are associated with the low quality of the data reported in the race/skin color category, since, due to high numbers of incomplete records, which were not considered valid, we needed to discard a substantial amount of data from our analysis. As a result, the information about certain racial subgroups in our study was not significant enough, meaning we needed to group the races as we did, which may have impacted our results. These results, in part, do not corroborate findings in literature.

It stands out that the methodological analysis of reliable and systematized data is vital to improve health systems and, consequently, the health of the population, since it guides managers in the organization and execution of actions, in addition to providing indicators of the patterns of disease and death in a group, as well as the efficiency of policies and programs developed to deal with this situation[17].

CONCLUSIONS

Our analyses have shown that there are statistically significant differences between the general incidence trends among the three groups analyzed. However, when incidence trends by sex and age group were compared to general, sex, and age group death trends, there was no statistical significance. The lack of association could be related to the fact that race/skin color was often not reported in COVID-19 notification forms and, thus, was unAvailable from the databases.

This underreporting helps replicate the institutional racism in Brazil, increasing the vulnerability of this population group and reiterating the need for quality data on race/skin color, considering the influence from other social determinants, since it is noteworthy that these factors, as a group, have an influence in the process of disease and death by COVID-19. These findings reiterate the importance of disseminating official, well-reported epidemiological data to promote effective public policies and strategies that can guarantee equality in dealing with a disease.

Finally, the findings of this study signal the need to develop retrospective research to analyze and compare clinical aspects, hospitalization needs, and the outcome of COVID-19 in the different ethnic/skin color groups.

REFERENCES

1. Albuquerque LP, Silva RB, Araújo RMS. COVID-19: origin, pathogenesis, transmission, clinical aspects and current therapeutic strategies. Rev Prev Infecç Saúde [Internet]. 2020 [cited 2021 mar. 13];6(10432):1-16. Available from: https://doi.org/10.26694/repis.v6i0.10432

2. Organização Mundial da Saúde. WHO Coronavirus (COVID-19) Dashboard. [Internet]. Genebra: OMS; 2022[cited 2022 Jul. 1]. Available from: https://COVID19.who.int/

3. Ministério da Saúde (BR). Secretaria de Vigilância em Saúde (SVS). Guia de Vigilância Epidemiológica do COVID-19. Painel Coronavírus. Brasília: MS; 2020. Available from: https://COVID.saude.gov.br/

4. Cavalcante JR, Cardoso-dos-Santos AC, Bremm JM, Lobo AP, Macário EM, de Oliveira WK, et al. COVID-19 no Brasil: evolução da epidemia até a semana epidemiológica 20 de 2020. Epidemiol Serv Saúde [Internet]. 2020 [cited 2021 Mar. 13];29(4):1-13. Available from: https://doi.org/10.5123/s1679-49742020000400010

5. Cestari VRF, Florêncio RS, Sousa GJB, Garces TS, Maranhão TA, Castro RR, et al. Vulnerabilidade social e incidência de COVID-19 em uma metrópole brasileira. Ciênc Saúde Colet [Internet]. 2021[cited 2021 Mar. 13];26(3). Available from: https://doi.org/10.1590/1413-81232021263.42372020

6. Martins-Filho PR, Araújo BCL, Sposato KB, Araújo AAS, Quintans-Júnior LJ, Santos VS. Racial Disparities in COVID-19-related Deaths in Brazil: Black Lives Matter. J Epidemiol [Internet]. 2021[cited 2021 Mar. 13];31(3):239–40. Available from: https://doi.org/10.2188/jea.JE20200589

7. Baqui P, Bica I, Marra V, Ercole A, Schaar M. Ethnic and regional variations in hospital mortality from COVID-19 in Brazil: a cross-sectional observational study. Lancet Glob Health [Internet]. 2020[cited 2021 Mar. 13];8(8):1018-26. Available from: https://doi.org/10.1016/S2214-109X(20)30285-0

8. Ferreira RBS; CaMargo CL. Vulnerabilidade da população negra brasileira frente à evolução da pandemia por COVID-19. Rev Cuid.

[Internet]. 2021 [cited 2022 Fev 10];12(2):2-12. Available from: http://dx.doi.org/10.15649/cuidarte.1322

9. Peres IT, Bastos LSL, Gelli JGM, Marchesi JF, Dantas LF, Antunes BBP, et al. Sociodemographic factors associated with COVID-19 in-hospital mortality in Brazil. Public Health [Internet]. 2021[cited 2021 Mar. 13];192:15-20. Available from: https://www.sciencedirect.com/science/article/pii/S0033350621000160#!

10. Fundação Sistema Estadual de Análise de Dados – SEADE [homepage]. Available from: https://www.seade.gov.br/coronavirus/#

11. Instituo Brasileiro de Geografia e Estatística. Censo 2010. Rio de Janeiro: IBGE; 2010. Available from: https://sidra.ibge.gov.br/tabela/2093#resultado

12. Cameron AC, Trivedi PK. Regression analysis of count data. New York: Cambridge Press; 1998.

13. Silva NN, Favacho VBC, Boska GA, Andrade EC, Merces NP, Oliveira MAF. Access of the black population to health services: integrative review. Rev Bras Enferm [Internet]. 2020[cited 2021 Mar. 13];73(4):e20180834. Available from: http://dx.doi.org/10.1590/0034-7167-2018-0834

14. Ayres J, Calazans GJ, Saletti Filho HC, França Jr I. Risco, vulnerabilidade e práticas de prevenção e promoção da saúde. In: Campos G, Minayo MCS, Akerman M, Drumond Jr M, Carvalho YM, organizadores. Tratado de saúde coletiva São Paulo: Editora Fiocruz; 2006. [cited 2023 Set 23];375-417

15. Werneck, J. Racismo institucional e saúde da população negra. Saude Soc; 2016. [cited 2023 Sept 23];25(3), 535–549. Available from: https://doi.org/10.1590/S0104-129020162610

16. Silva HCB da, Lima TCS de. Racismo institucional: violação do direito à saúde e demanda ao Serviço Social. Rev katálysis [Internet]. 2021;[cited 2023 Sept 23];24(2):331–41. Available from: https://doi.org/10.1590/1982-0259.2021.e77586

17. Araujo EM, Caldwell KL, Santos MPA, Souza IM, Rosa PLFS, Santos ABS, et al. Morbimortalidade pela COVID-19 segundo raça/cor/etnia: a experiência do Brasil e dos Estados Unidos. Saúde Debate [Internet]. 2020[cited 2021 Mar. 13];44(spe4):191-205. Available from: https://doi.org/10.1590/0103-11042020E412

18. Santos GRAC, Gama LS, Santos AS, Nascimento V, Nogueira RS, Silva BAT, et al. Perfil epidemiológico dos casos e óbitos por COVID-19 nos estados da região nordeste. Rev Eletrônica Acervo Saúde [Internet]. 2020[cited 2021 mar. 13];12(12):1-9. Available from: https://doi.org/10.25248/reas.e4251.2020

19. Matos M. Pandemia COVID-19 e as mulheres. Boletim Cientistas Sociais, n. 11, Portal das Ciências Sociais Brasileiras, 02 abr 2020[cited 2021 mar. 13]. Available from: http://www.anpocs.com/index.php/publicacoes-sp-2056165036/boletim-cientistas-sociais/2322-boletim-n-11-pandemia-COVID-19-e-as-mulheres

20. Estrela FM, Soares CFS, Cruz MA, Silva AF, Santos JRL, Moreira TMO, et al. Pandemia da COVID 19: refletindo as vulnerabilidades à luz do gênero, raça e classe. Ciênc Saúde Colet [Internet]. 2020[cited 2021 Mar. 13];25(9):3431-6. Available from: https://doi.org/10.1590/1413-81232020259.14052020

21. Porto EF, Domingues AL, Souza AC, Miranda MKV, Froes MBC, Pasqualinoto SRV. Mortalidade por COVID-19 no Brasil: perfil sociodemográfico das primeiras semanas. Res Soc Dev [Internet]. 2021[cited 2021 Mar. 13];10(1):1-8. Available from: http://dx.doi.org/10.33448/rsd-v10i1.11588

22. Ramos D, Goés E, Pinto Junior EP, Ferreira A, Rebouças P, Rocha A, et al. COVID-19 – Reflexões acerca das desigualdades no acesso ao diagnóstico. Rede CoVida: Ciência, Informação e Solidariedade. Relatório Técnico, 13 de abril de 2020 [cited 2021 Mar. 13]. Available from: https://redeCOVIDa.org/main-site-COVIDa/wp-content/uploads/2020/04/texto_sintese-acesso-diagnostico_final.pdf

23. Lorenz C, Ferreira PM, Masuda ET, Lucas PCC, Palasio RGS, Nielsen L, et al. COVID-19 no estado de São Paulo: a evolução de uma pandemia. Rev Bras Epidemiol [Internet]. 2021[cited 2021 Mar. 13];24:1-14. Available from: https://doi.org/10.1590/1980-549720210040

24. Prates I, Lima M, Oliveira WM, Alves EL, Nogueira A, Duarte ML. Nota Técnica No. 34: desigualdades raciais e de gênero aumentam a mortalidade por COVID-19, mesmo dentro da mesma ocupação. Rede de Políticas Públicas e Sociedade. Boletim 34, set. 2021[cited 2021 Mar. 13]. Available from: https://redepesquisasolidaria.org/boletins/boletim-34-boletins/desigualdades-raciais-e-de-genero-aumentam-a-mortalidade-por-COVID-19-mesmo-dentro-da-mesma-ocupacao/

25. Yanez ND, Weiss NS, Romand JA, Treggiari MM. COVID-19 mortality risk for older men and women. BMC Public Health [Internet]. 2020[cited 2021 Mar. 13];20(1):1-7. Available from: https://pubmed.ncbi.nlm.nih.gov/33213391/

26. Oliveira BLCA, Thomaz EBAF, Silva RA. Associação da cor/raça aos indicadores de saúde para idosos no Brasil: um estudo baseado na Pesquisa Nacional por Amostra de Domicílios (2008). Cad Saúde Pública [Internet]. 2014[cited 2021 Mar. 13];30(7):1-15. Available from: https://www.scielo.br/j/csp/a/JVSx9HymqJ6RByWpQzP3jqd/?lang=pt&format=pdf

27. Araujo AMC, Lombardi MR. Trabalho informal, gênero e raça no Brasil, no início do século XXI. Cad Pesqui [Internet]. 2013[cited 2021 Mar. 13];43(149):452-77. Available from: https://doi.org/10.1590/S0100-15742013000200005

28. Santos JR, Vargas JC. Pandemia e genocídio da população negra: cenários da necropolítica Estatal. METAXY: Rev Bras Cultura e Políticas em Direitos Humanos [Internet]. 2020[cited 2021 Mar. 13];3(1):239-54. Available from: https://revistas.ufrj.br/index.php/metaxy