

















Living conditions, seroprevalence and symptoms of COVID-19 in slums in the Metropolitan Region of Vitória (Espírito Santo)

Condições de vida, soro prevalência e sintomas de COVID-19 em favelas na Região Metropolitana de Vitória (Espírito Santo)

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ABSTRACT: *Objective:* to estimate the prevalence of SARS-CoV-2 infection in residents of the Greater Vitória region living in subnormal and non-subnormal agglomerates, and to compare sociodemographic and clinical characteristics of total residents (infected and not infected with SARS-CoV-2) between them. *Methods:* Population-based prevalence study conducted by serological testing in 2020, with a study unit in households in Greater Vitória, grouped into census tracts classified as sub-normal agglomerates and non-sub-normal agglomerates. The two groups were compared in terms of prevalence and associated factors. The significance level adopted was 5%. *Results:* The prevalence found in the sub-normal clusters was 12.05% (95%CI 9.59–14.50), and in the non-sub-normal clusters 10.23% (95%CI 7.97–12.50) this difference was not statistically significant ($p = 0.273$). Comparing the sociodemographic characteristics, more people who declare themselves to be of mixed race were found in the sub-normal clusters, a higher percentage of illiterates and people with only elementary education, greater number of residents per household, longer stay in public transportation, sharing a bathroom with another household, fewer bedrooms per residence and higher frequency of irregular water supply when compared to non-sub-normal clusters ($p < 0.05$). *Conclusions:* The epidemiological characteristics of sub-normal clusters' residents show the social inequalities that can hinder control measures in a pandemic situation.

Keywords: Coronavirus infections. Prevalence. Housing. Demography.

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RESUMO: *Objetivo:* Estimar prevalência de infecção pelo SARS-CoV-2 em residentes na região da Grande Vitória, moradores de aglomerados subnormais e não subnormais, e comparar características sociodemográficas e clínicas dos residentes totais (infectados e não infectados com o SARS-CoV-2), entre esses aglomerados. *Métodos:* Estudo de prevalência de base populacional, por meio de teste sorológico realizado em 2020, com unidade de estudo em domicílios da Grande Vitória, agrupados em setores censitários classificados como aglomerados subnormais e aglomerados não subnormais. Os dois grupos foram comparados quanto à prevalência e aos fatores associados. O nível de significância adotado foi de 5%. *Resultados:* A prevalência encontrada em não aglomerados subnormais foi 12,05% (IC95% 9,59–14,50) e no grupo aglomerados não subnormais foi 10,23% (IC95% 7,97–12,50), e essa diferença não foi estatisticamente significativa ($p = 0,273$). Comparando-se as características sociodemográficas, encontraram-se nos aglomerados subnormais mais pessoas que se autodeclararam da raça/cor parda, percentual maior de analfabetos e de pessoas apenas com ensino fundamental, maior número de moradores por domicílio, maior permanência em transporte coletivo, compartilhamento de banheiro com outro domicílio, menos dormitórios por residência e maior frequência de abastecimento irregular de água quando comparado aos aglomerados não subnormais ($p < 0,05$). *Conclusões:* As características epidemiológicas dos moradores de aglomerados subnormais evidenciam as desigualdades sociais que podem dificultar as medidas de controle em uma situação de pandemia. *Palavras-chave:* Covid-19. Prevalência. Habitação. Distribuição espacial da população.

INTRODUCTION

The new coronavirus, called SARS-CoV-2, which causes the COVID-19 disease, was discovered on December 31, 2019 when cases of pneumonia diagnosed in Wuhan, China, were being investigated. The disease spread rapidly around the world and was declared, on January 30, 2020, as a Public Health Emergency of International Concern (PHEIC) by the World Health Organization (WHO)¹. On March 11 of the same year, the WHO declared a COVID-19 pandemic. On July 12, 2020, at a global level, the number of confirmed cases had already surpassed 12,552,765 and the number of deaths was at 561,6171.2. In Brazil, the first case was confirmed on February 26, 2020. As of July 12, 2020, 1,800,827 cases and 70,398 deaths had been registered³.

When it comes to communicable and contagious diseases involving droplets or aerosols, situations that allow greater physical proximity, like housings with reduced space or other socioeconomic vulnerability conditions, facilitate their spread⁴⁻⁸. For COVID-19, this airborne transmission, similar to other infectious diseases such as tuberculosis, leprosy, among others, is also possible through contact with surfaces contaminated by the virus⁹.

The Brazilian Institute of Geography and Statistics (IBGE), through geographic analysis, classifies territorial areas according to social, economic and environmental criteria, aggregating areas with similar characteristics. This classification includes subnormal agglomerates (“*aglomerados subnormais*”, AGSN), which are forms of irregular occupation of land owned by others (public or private) for housing purposes in urban areas and, in general, characterized by an irregular urban pattern, lack of essential public services and location with

restrictions on occupation. The AGSN can contribute to the dissemination of COVID-19, either because of its structural and urban characteristics, or because of the socioeconomic conditions of residents¹⁰. For this article, the use of the term AGSN was standardized due to its definition by the IBGE mentioned.

The AGSN are made up of people subject to greater exposure and vulnerability, with households whose predominant characteristics are high density of inhabitants, poor lighting and ventilation conditions, and limited access to sanitation conditions (potable water, sewage, garbage collection), which is also evidenced by the results of this serological survey. In Brazil, these irregular settlements are known by various names, such as slums, invasions, grottos, lowlands, communities, villages, irregular subdivisions, stilts, among others¹⁰.

Estimating the magnitude of the disease in population-based studies and producing health indicators that can guide more focused public policies according to the epidemiological situation is one of the missions of epidemiology. The analysis of greater social vulnerability and its possible consequences for health services in the context of COVID-19, considering the socioeconomic characteristics and epidemiological profile of the population, can contribute to the establishment of these public policies. This study, therefore, aimed to:

1. estimate the prevalence of infection by SARS-CoV-2 in residents of the Greater Vitória region, residents of AGSN and non-subnormal agglomerations (“*aglomerados não subnormais*”, AGNSN);
2. compare sociodemographic and clinical characteristics of total residents (infected and not infected with SARS-CoV-2) between conglomerates.

METHODS

This is a cross-sectional population-based study on the prevalence of SARS-CoV-2 infection, carried out between June 22 and 26, 2020, with households in Greater Vitória as the study unit, grouped into census tracts classified as AGSN and AGNSN. Then, a comparative study between the two populations was made. The study design was based on the protocol proposed by the WHO¹¹.

This study was carried out in the Metropolitan Region of Espírito Santo (ES), according to the division of the state into macro-regions. Samples were obtained in the cities of Grande Vitória with the largest urban populations: Vitória, Vila Velha, Serra and Cariacica.

Although these four municipalities occupy 2.4% of the state's geographical area due to population density, the AGSN in these municipalities represent 49.7% of the AGSN in the whole state of ES. According to the 2010 IBGE Census, the total population of these municipalities is 1,500,392, of which 151,550 live in AGSN and the rest in AGNSN¹². The Metropolitan Region of Greater Vitória has AGSN inserted in the respective municipalities, forming areas contiguous to the AGNSN, and the entire region can be seen as a homogeneous area stratified only by AGSN and AGNSN.

To calculate the prevalence samples, the populations defined by the 2010 IBGE Census were considered, with expected prevalence of infection by COVID-19 (estimated by previous stages of the household survey in ES¹³) of 13% (AGSN) and 9% (AGNSN), sampling errors of 2.5–2.1%, respectively, and a significance level of 5%. The minimum sizes were 692 individuals in AGSN and 714 in AGNSN. These sample sizes have a statistical power of 70% to compare the prevalence between AGSN and AGNSN and above 80% for other comparisons. A systematic sampling by households was adopted, using the census sectors as clusters¹³.

In each municipality, census tracts were drawn and divided into two groups: AGSN and AGNSN, proportional to the size of the population in these municipalities. The draw took place in census sectors with urban population, with less than 100 hectares of area and more than 200 households, according to IBGE data for the 2020 Census. A random selection of households was carried out in the sectors, being only one resident selected at random. Each sector had 40 households.

Only individuals aged over 2 years were included to answer the questionnaire and blood sample collection for antibody detection test against SARS-CoV-2. To answer the interview, the resident should be over 16 years old or supervised by a responsible person.

For ethical reasons, in households where the selected individual tested positive, as well as in households with a symptomatic resident, the test was offered to the residents. These results, however, were not computed in the prevalence study.

The interviewers were previously trained to perform the exam with a blood sample obtained by means of digital puncture. The test used was the rapid immunochromatographic test for detection of Celer brand IgM and IgG antibody, in the Point Of Care (POC) test category, recommended by the WHO and registered with the National Health Surveillance Agency (ANVISA) under protocol 80537410048, with sensitivity of 86.4% and specificity of 97.63%, according to the manufacturer's data.

In addition to testing positive for SARS-CoV-2, taken as the outcome variable of this study, the following information was collected about the participants, according to geographic area: gender (female and male), age group (up to 20 years old, 21–40 years, 41–60 years, 61–80 years and 81 years and over), self-declared race/skin color (white, brown, black, yellow and indigenous), respondent's education (illiterate, incomplete 1st-4th grade of elementary school, complete 4th grade of elementary school, incomplete 5th-8th grade of elementary school, complete elementary school, incomplete high school, complete high school, incomplete higher education and complete higher education), number of household members (1, 2, 3, 4 or more), education of the person with the highest level of education in the household (illiterate, elementary school, high school, incomplete higher education and higher education), time on public transport per day (no resident uses, less than 30 minutes, between 30–60 minutes, more than 60 minutes), often needs to use transport per week (no resident uses it, up to three times, four times or more), bathroom (does not have a bathroom, exclusive bathroom, bathroom shared with another household/family), bedrooms (does not have a bedroom, one bedroom, two or three bedrooms, four bedrooms or more), water supply (no access to potable water; irregular supply, access on some days

of the week; regular supply, available all days of the week), comorbidities (hypertension, diabetes mellitus, asthma, cancer, kidney disease, heart disease, obesity and other comorbidities), went to the health unit (yes, no), signs and symptoms of COVID-19 15 days prior to the interview, with yes or no answers (cough, myalgia, fatigue, sore throat, anosmia, dyspnea, diarrhea, fever, tachycardia, abdominal pain, vomiting and other symptoms), and other unrelated symptoms.

Data were collected using an application developed specifically for the survey and recorded on smartphones provided by IBGE, with real-time transfer to the survey coordination center. These data formed a database analyzed statistically using the SPSS program, version 20.0. Frequency tables were made, and the prevalence for each group was estimated on a timely basis and by confidence interval. The two groups were compared in terms of prevalence and factors associated with COVID-19 in bivariate analyses (sociodemographic profile, COVID-19 positivity outcome, household characteristics, comorbidities and symptoms), using the χ^2 association test. The significance level adopted was 5%.

All individuals selected to participate in the survey were informed about the study objectives, risks and benefits, and each participant signed an Informed Consent Form, or an Informed Assent Form in the case of children. The material and information were only collected after the consent forms were signed. Cases with reactive or positive test results were notified to the city's Health Surveillance Department for the necessary measures. Appropriate biological safety measures were taken to ensure the health of field researchers who worked in the collection of data and biological material. The researchers were also evaluated with a rapid test to detect antibodies to SARS-CoV-2 before starting the field work, and the regional coordination was instructed to carry out the replacement of researchers in case of symptoms or a reagent test. The project was approved by the Research Ethics Committee of Universidade de Vila Velha, under opinion number 4.009,337.

RESULTS

A total of 1,447 households were visited, following the distribution proportional to the size of the population in the sample municipalities – Cariacica, 290 households (20.0%), Serra, 519 households (35.9%), Vila Velha, 406 households (28.1%), and Vitória, 232 (16.0%) households – and the stratification into cluster groups, 714 in AGSN and 733 in AGNSN.

In total, 161 people had reactive tests, being 86 among AGSN residents and 75 in other locations. The prevalence found in the slum group was 12.05% (95%CI 9.59–14.50), while in the AGNSN group it was 10.23% (95%CI 7.97–12.50). It is noteworthy that the ratio between prevalence values was 17.8% ($12.05 / 10.23 = 17.8\%$), which indicates an excess risk of 17.8% in the most vulnerable group, with no statistical difference between groups by the χ^2 test.

In households of individuals with reactive tests ($n = 161$), the test to detect antibodies was offered to all contacts present, excluding children under two years of age and those who did not wanted to perform the test.

When evaluating the results of reagent tests among contacts of selected individuals who had reagent tests in the AGSN group, at least one contact with a reagent test was found in 6.3% of the households, while in other sectors the percentage was 4.1 % ($p = 0.057$).

Comparing the sociodemographic characteristics of people living in AGSN with those living in AGNSN, a higher percentage of people who declare themselves brown is seen in AGSN, while in the AGNSN, the highest percentage was self-declared white ($p < 0.001$). There was also a higher percentage of illiterates and people with only elementary education in the group of residents in AGSN compared to the highest percentage of people with complete higher education in AGNSN ($p < 0.001$), as shown in Table 1.

As for the characteristics of residents and their households, there was a higher number of residents per household ($p = 0.012$), lower educational level of the resident with more years of education ($p < 0.001$), longer stay in public transport ($p < 0.001$), bathroom shared with another household ($p < 0.001$), fewer bedrooms per household ($p = 0.002$) and higher frequency of irregular water supply ($p = 0.009$). These data are shown in Table 2. Regarding comorbidities, there were no statistically significant differences between residents of different types of agglomerates, as shown in Table 3.

Regarding symptoms self-reported by residents who tested positive, cough ($p = 0.012$), myalgia (muscle pain) ($p = 0.001$), fatigue ($p < 0.001$), anosmia (loss of taste and smell) ($p < 0.001$), fever ($p < 0.001$) and tachycardia ($p = 0.022$) were more common, but these symptoms were not perceived as a reason for seeking medical care ($p = 0.200$) (Table 4).

DISCUSSION

This was the first study that sought to assess the prevalence of individuals infected with SARS-CoV-2 in a population survey comparing AGSN and AGNSN groups. This approach by territorial cuts classified as AGSN per the 2010 Demographic Census¹² can help studies that aim to understand the impacts of social inequalities on the emergence or worsening of diseases and point out public policies for social protection and control of the pandemic.

The study found a prevalence of 12.05% (95%CI 9.59–14.50) of individuals infected by SARS-CoV-2 in the AGSN group and 10.23% (95%CI 7.97–12.50) in the AGNSN group. The frequency of at least one contact with a reactive test among the positive respondents in the AGSN group was 6.3%, while in the other clusters the percentage was 4.1%.

In the same period of the pandemic, Espírito Santo had 9.61% (data not yet published) of prevalence of COVID-19 evaluated in four stages of the epidemiological survey. The municipalities of Greater Vitória, which concentrated most cases, had 11.51% of its population infected. In municipalities in the countryside, the prevalence rose from 3.12 to 4.35%¹⁴.

Although there was no statistically significant difference between the prevalence of positive individuals when comparing both clusters (AGNSN and AGSN), sociodemographic characteristics such as housing conditions and self-reported symptoms of COVID-19 among positive individuals showed that residents in the AGSN are in greater social vulnerability,

Table 1. Frequency of variables of the sociodemographic profile per total, and subnormal and non-subnormal clusters groups.

	Category	Group						p-value
		Total		AGSN		AGNSN		
		n	%	n	%	n	%	
Gender	Female	940	65.0	465	65.1	475	64.8	0.897
	Male	507	35.0	249	34.9	258	35.2	
Age (years)	up to 20	84	5.8	35	4.9	49	6.7	0.307
	21–40	463	32.0	240	33.6	223	30.4	
	41–60	525	36.3	262	36.7	263	35.9	
	61–80	335	23.2	161	22.5	174	23.7	
	81	40	2.8	16	2.2	24	3.3	
Race, skin color	White	515	35.6	217	30.4	298	40.7	0.001
	Borwn	727	50.2	405	56.7	322	43.9	
	Black	193	13.3	84	11.8	109	14.9	
	Yellow	11	0.8	7	1.0	4	0.5	
	Indigenous	1	0.1	1	0.1	0	0.0	
Education	Illiterate	44	3.1	34	4.8	10	1.4	0.001
	Incomplete 1st-4th grade of elementary school	163	11.3	105	14.8	58	8.0	
	4th grade of elementary school	76	5.3	52	7.3	24	3.3	
	incomplete 5th-8th grade of elementary school	161	11.2	95	13.4	66	9.1	
	Complete elementary school	121	8.4	70	9.8	51	7.0	
	Incomplete high school	97	6.7	66	9.3	31	4.3	
	Complete high school	507	35.3	224	31.5	283	38.9	
	Incomplete higher education	62	4.3	21	3.0	41	5.6	
	Complete higher education	207	14.4	44	6.2	163	22.4	

AGSN: subnormal clusters; AGNSN: non-subnormal clusters. p-value of the χ^2 test.

Table 2. Frequency of household profile variables per total, subnormal and non-subnormal clusters.

	Category	Group						p-value
		Total		AGSN		AGNSN		
		n	%	n	%	n	%	
People living in household	1	155	10.7	71	9.9	84	11.5	0.012
	2	402	27.8	180	25.2	222	30.3	
	3	387	26.7	186	26.1	201	27.4	
	4 or more	503	34.8	277	38.8	226	30.8	
Highest education in household	Illiterate	16	1.1	12	1.7	4	0.5	0.001
	Elementary School	354	24.5	231	32.4	123	16.8	
	High school	630	43.5	343	48.0	287	39.2	
	Incomplete higher education	101	7.0	41	5.7	60	8.2	
	Higher education	346	23.9	87	12.2	259	35.3	
Time of commuting in public transportation	No resident uses public transportation	827	57.4	391	54.8	436	60.0	0.001
	Less than 30 minutes	230	16.0	89	12.5	141	19.4	
	Between 30 and 60 minutes	250	17.4	159	22.3	91	12.5	
	More than 60 minutes	133	9.2	74	10.4	59	8.1	
Commuting in public transportation	No resident uses	838	58.2	393	55.1	445	61.3	0.059
	Up to 3 times a week	337	23.4	180	25.2	157	21.6	
	4 times or more a week	264	18.3	140	19.6	124	17.1	
Bathroom	No bathroom	4	0.3	2	0.3	2	0.3	0.001
	Use bathroom shared with another household/family	323	22.4	224	31.4	99	13.6	
	Exclusive bathroom	1113	77.3	487	68.3	626	86.1	
Bedrooms	No bedroom	4	0.3	2	0.3	2	0.3	0.002
	1 bedroom	188	13.1	115	16.1	73	10.0	
	2 or 3 bedrooms	1140	79.2	535	75.0	605	83.2	
	4 bedrooms or more	108	7.5	61	8.6	47	6.5	
Water	No access to potable water	6	0.4	3	0.4	3	0.4	0.009
	Irregular water supply (some days of the week)	16	1.1	14	2.0	2	0.3	
	Regular water supply (all days of the week)	1418	98.5	696	97.6	722	99.3	

AGSN: subnormal clusters; AGNSN: non-subnormal clusters. p-value of the χ^2 test.

Table 3. Frequency of comorbidities of respondents per total, subnormal clusters and non-subnormal clusters.

	Group						p-value
	Total		AGSN		AGNSN		
	n	%	n	%	n	%	
Arterial hypertension	478	33.0	234	32.8	244	33.3	0.835
Diabetes mellitus	195	13.5	95	13.3	100	13.6	0.851
Asthma	120	8.3	53	7.4	67	9.1	0.236
Neoplasm	23	1.6	8	1.1	15	2.0	0.159
Kidney disease	25	1.7	9	1.3	16	2.2	0.178
Cardiovascular disease	86	5.9	43	6.0	43	5.9	0.900
Obesity	196	13.5	101	14.1	95	13.0	0.510
Other comorbidities	118	8.2	55	7.7	63	8.6	0.535

AGSN: subnormal clusters; AGNSN: non-subnormal clusters. p-value of the χ^2 test.

Table 4. Variables of symptoms and search for health unit per total number of respondents, subnormal clusters and non-subnormal clusters, from the highest frequency.

	Group						p-value
	Total		AGSN		AGNSN		
	n	%	n	%	n	%	
Cough	234	16.2	133	18.6	101	13.8	0.012
Myalgia	192	13.3	116	16.2	76	10.4	0.001
Fatigue	163	11.3	103	14.4	60	8.2	0.001
Sore throat	159	11.0	73	10.2	86	11.7	0.359
Anosmia	137	9.5	86	12.0	51	7.0	0.001
Dyspnea	133	9.2	72	10.1	61	8.3	0.246
Diarrhea	111	7.7	55	7.7	56	7.6	0.964
Other symptoms	109	7.5	58	8.1	51	7.0	0.705
Fever	104	7.2	66	9.2	38	5.2	0.003
Tachycardia	92	6.4	56	7.8	36	4.9	0.022
Abdominal pain	87	6.0	46	6.4	41	5.6	0.497
Vomiting	31	2.1	17	2.4	14	1.9	0.536
Went to the HU	260	18.0	119	16.7	141	19.2	0.203

HU: health unit; AGSN: subnormal clusters; AGNSN: non-subnormal clusters. p-value of the χ^2 test.

which could increase exposure to the disease within the household, as warned in studies by the IBGE¹⁰.

In Espírito Santo, 14.37% of the population does not have access to water through the general distribution network, 21.83% do not have access to sewage through the collection or rainwater system, 8.73% do not have access to direct or indirect garbage collection, and 23.47% do not have simultaneous access to the three sanitation services¹⁵. Regarding housing conditions, there are 13,136 people living in precarious situation and 6,295 living in households with excessive density¹².

Recent data from IBGE (2019) were released prior to the 2020 Census to assist in the performance of the government in confronting COVID-19. The data show that Espírito Santo is one of the states with the highest number of households in AGSN, ranking second, with 26.10%. This corresponds to 306,439 households, lower only than in Amazonas, where the value is 34.59%. In the state capital, Vitória, there are 34,393 households in AGSN, which represent 33.15% of all in the municipality. By definition, the AGSN generally hold populations with more precarious socioeconomic, sanitation and housing conditions. As an aggravating factor, many AGSN have an extremely high density of buildings¹⁰.

Although infected AGSN residents reported having more symptoms, this situation did not lead them to seek health services, for reasons that it was not possible to identify given the methodology and objectives of this study. However, data from the National Household Sample Survey (PNAD) have shown that, despite their need for health care, individuals with lower purchasing power tend to consume less these services^{15,16}.

Adequate living and mobility conditions help not only the prevention of chronic-degenerative diseases and the promotion of well-being, but also the control of infectious diseases such as dengue, chikungunya, zika and, currently, COVID-19^{5-8,17,18}. Studies that analyzed the characteristics of these AGSN in other infectious diseases showed their association with social inequality, poverty and precarious living conditions¹⁷⁻²². The geographic distribution combined with low education, social inequality and migratory movements are also pointed as determining factors of illness^{23,24}. However, our results did not find a statistically significant difference between the prevalence of reactive tests in the two types of clusters, despite the statistical differences in the housing conditions and transport habits of the residents, it is possible that, at the time of this survey, the situation of COVID-19 transmission among residents of the areas assessed had a similar behavior, which could be related to the place of work and leisure and mobility conditions in the Greater Vitória region. However, variables related to the place of work and leisure activities were not included in the questionnaire of this survey.

One of the limitations of this study was its cross-sectional design, which does not allow the determination of causality. Carrying out the household survey during business hours and on weekdays could influence the result, since only the residents present in the household at the time of data collection entered the draw to answer the questionnaire and to be tested for antibodies. Furthermore, transmission could be in different moments in the

two populations. Also regarding the design, it is important to say that, as in other randomized population-based studies, people with severe disease or who required hospitalization were not present to be computed in the prevalence. During the study, the state of Espírito Santo had no problems in admitting patients to both public and private health services. It is assumed that this limitation affected both studied groups equally²⁵.

Important to note that the results of the reagent tests among the contacts of selected individuals who had reagent tests in the AGSN group was higher, which could indicate that housing conditions, like in other infectious diseases, influence household transmission^{7,8}.

Bezerra et al.²⁶, evaluating factors associated with the behavior of the population during the pandemic in Brazil, showed that people who reported living in worse housing conditions were willing to spend less time in isolation (73.9%). Among people who were not isolated (10.7% of the total), 75.8% said they believed that social isolation would reduce the number of victims of COVID-19. The authors concluded that people's perception of social isolation as a measure to mitigate the pandemic varies according to income, education, age and gender²⁶.

A study evaluating the disparity in subway use and the outcome of COVID-19 in New York pointed to inequalities as factors that increase vulnerability to the disease²⁷. Areas with a lower median income and a higher percentage of self-declared non-white individuals had a higher percentage of essential workers and a higher percentage of health professionals who used more subways during the pandemic. In poorer neighborhoods, greater mobility of the population in relation to the richer ones was seen, which increases vulnerability to COVID-19²⁷. Although the theoretical foundation about areas with lower median income in other countries indicates a direction, in this study this variable was not measured, setting up a limitation.

Another study conducted in the United States using the postal code as the unit of analysis showed that, despite race being used as a proxy variable for socioeconomic status, the most significant predictor of a COVID-19 positive case was an individual's structural environment, that is, population density in their place of residence²⁸.

Old issues are highlighted at this time of pandemic, such as sanitation, household density, precarious housing and mobility. The city was historically formed in segregated spaces between those who could afford it and those who improvised ways of living, occupying spaces without infrastructure and environmentally fragile. This formation of cities without concern for social inequality brings problems that have been increasingly recurrent and larger, such as floods, droughts and the spread of diseases. This inequality increases daily, and the COVID-19 pandemic shows us how this discrepancy is harmful to everyone, even those who live in adequate conditions and have access to sanitation²⁷⁻²⁹.

Finally, as the household is not only the smallest spatial unit where the process of transmission of infectious agents takes place, but also a fundamental unit in the study of social reproduction³⁰, in which the cultural and economic relations of groups in their collectivity materialize, actions that can disproportionately reduce severe cases should be prioritized in government public policies aimed at the socially vulnerable.

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