Social isolation and the speed of covid-19 cases: measures to prevent transmission

Isolamento social e a velocidade de casos de covid-19: medida de prevenção da transmissão

Aislamiento social e la velocidad de casos por covid-19: medida para prevenir la transmisión

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ABSTRACT

Objective: To evaluate the social isolation index and the speed of new cases of Covid-19 in Brazil.

Methods: Quantitative ecological, documentary, descriptive study using secondary data, comparing the period from March 14 to May 1, 2020, carried out with the 27 Brazilian federative units, characterizing the study population. The data were analyzed through descriptive statistics using the Statistical Package for the Social Sciences-SPSS® software, evaluating the correlation between the social isolation index and the number of new cases of Covid-19, using Pearson's correlation coefficient.

Results: The increase in Covid-19 cases is exponential. There was a significant, negative correlation regarding the social isolation index and the speed of the number of new cases by Pearson's coefficient, which means that as the first one increases, the second one decreases.

Conclusion: Social isolation measures have significant effects on the rate of coronavirus infection in the population.

Keywords: Coronavirus infections. Coronavirus. Social isolation. Communicable diseases. Public health. Communicable disease control.

RESUMO

Objetivo: Avaliar o índice de isolamento social e a velocidade de casos novos de Covid-19 no Brasil.

Métodos: Ecológico quantitativo, documental, descritivo, utilizando dados secundários, comparando-se o período de 14 de março a 1º de maio de 2020, nas 27 unidades federativas brasileiras, caracterizando a população do estudo. Realizou-se análise estatística descritiva, no software Statistical Package for the Social Sciences®, avaliando-se a correlação entre o índice de isolamento social e o número de novos casos de Covid-19, utilizando o Coeficiente de correlação de Pearson.

Resultados: O aumento dos casos de Covid-19 se apresenta de forma exponencial. Houve correlação significativa, negativa quanto ao índice de isolamento social e a velocidade do número de casos novos pelo coeficiente de Pearson, o que significa que, à medida que o primeiro aumenta, o segundo decresce.

Conclusão: Medidas de isolamento social têm efeitos significativos sobre a velocidade de infecção por coronavírus na população.

Palavras-chave: Infecções por coronavírus. Coronavírus. Isolamento social. Doenças transmissíveis. Saúde pública. Controle de doenças transmissíveis.

RESUMEN

Objetivo: Evaluar el índice de aislamiento social y la velocidad de los nuevos casos de Covid-19 en Brasil.

Metodologia: Estudio ecológico cuantitativo, documental, descriptivo, utilizando datos secundarios, comparando el período del 14 de marzo al 1 de mayo de 2020, realizado con las 27 unidades federativas brasileñas, caracterizando l apoblación de estudio. Los datos se analizaron mediante análisis estadístico descriptivo, utilizando el paquete estadístico para el software Social Sciences® evaluando la correlación entre el índice de aislamiento social y el número de casos nuevos de Covid-19, utilizando el coeficiente de correlación de Pearson.

Resultados: El aumento em los casos de Covid-19 es exponencial. Hubo una correlación negativa significativa con respecto al índice de aislamiento social y la velocidad del número de casos nuevos según el coeficiente de Pearson, lo que significa que a medida que el primero aumenta, el segundo disminuye.

Conclusión: Las medidas de aislamiento social tienen efectos significativos sobre la tasa de infección por coronavirus en la población.

Palabras clave: Infecciones por coronavirus. Coronavírus. Aislamiento social. Enfermedades transmisibles. Salud pública. Control de enfermidades transmisibles.

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■ INTRODUCTION

The current Covid-19 global pandemic is related to an acute respiratory disease caused by the novel coronavirus (SARS-CoV-2) whose evolution is still little known[1].

On December 31, 2019, the World Health Organization office in China received an epidemiological alert on cases of pneumonia with an unknown cause in the city of Wuhan, in Hubei province. On January 7, 2020, Chinese researchers isolated a SARS-COV-2 strain of the coronavirus family, which had not yet been detected in humans. On February 11, 2020, the virus was officially called coronavirus, which causes Covid-19[2].

Thus, in 2020 the pandemic of the disease known worldwide as Covid-19, caused by the novel coronavirus, named SARS-CoV-2, led to a serious global health, economic, social and political crisis[2], a fact that has required expressive performance of Nursing in multiple spaces of direct and/or indirect assistance.

Based on mathematical models, as in other countries[3], it was possible to estimate the impact of the disease. Following the situation in China, Brazil, on January 22, 2020, activated the Public Health Emergency Operations Center for the disease (COE Covid-19). At that time, it was clear that this was a new virus with a strong ability to fill the beds of intensive care units.

The contagious and viral transmission disease happens from the infected person to a healthy one and, although Covid-19 does not appear to be the same severity as SARS, there is a superior transmissibility that makes it more lethal in absolute numbers, in addition to being a new virus for human beings. Therefore, it does not confer prior immunity, making their degree of infection even greater[2–3].

Given its intercontinental spread, on March 11, 2020, the disease took on global dimensions, being declared a pandemic by the World Health Organization (WHO); on that date it was already present in a total of 114 countries, requiring a work on a national and global scale for recovery and control[4].

For this reason, all countries started to plan and intervene according to WHO guidelines, which recommended measures of social distance and hand hygiene as the most effective interventions in combating the Covid-19 pandemic, also named non-pharmacological, in view of the unavailability of specific medications and vaccines that would cure and prevent transmission so far[2].

In Brazil, this was no different, based on the experience of other countries with a previous incidence of the disease, and it started to adopt measures of social isolation, since it is the most effective way to prevent the collapse of the hospital system and to achieve lower mortality in absolute numbers[3–4].

However, recent changes in the diagnostic criteria of the disease have led to an increase in the rate of new cases and, every day, increasing numbers and challenges have been the subject of intense debate on the topic by the scientific community[1].

Thus, nursing is highlighted in the health care of the population, strengthening the actions of promotion and prevention, education and development of nursing professionals, having the orientation towards social isolation as a measure to prevent the transmission of Covid-19[3].Therefore, while social isolation actions are considered central tools to cope with Covid-19, and health and nursing teams focus on this orientation to educate the population, reliable scientific evidence on social isolation becomes potential for recognizing the role of nursing professionals in facing the pandemic[5].

Thus, this study has the following research question: Are social isolation actions correlated with the speed of new cases of Covid-19 in Brazil? Taking as a study hypothesis that social isolation actions slow the speed of new cases of Covid-19, leading this research to the objective of evaluating the social isolation index and the speed of new cases of Covid-19 in Brazil.

■ METHODOLOGY

This is an ecological study, with a documentary source, secondary data, with a descriptive characteristic and of a quantitative nature. The collection of public data on the platforms contemplates the period in which the data were available, from March 14 to May 1.

For the research all 27 Brazilian federative units were considered, characterizing the population of this study, having as inclusion criteria: those that started to present more than 100 cases of Covid-19 in the country per day, from the period of availability of data, and which presented their respective indexes of social isolation available, totaling 27 federative units participating in the study.

The quantitative design was defined in an attempt to demonstrate and represent the findings, favoring the reach of inferences through the variables used composed of the number of new cases of Covid-19 per day in Brazil in the period, as well as the variable about the weighted average of the social isolation index in Brazil per day in the period.

To obtain social isolation data in Brazil, the data released by the startup In Loco®, which is a Brazilian technology company that provides intelligence which collects anonymous

location data from a total of 60 million devices, were used. The Social Isolation Index was developed by In Loco® and is publicly accessible, in order to help combat the Covid-19 pandemic in Brazil, characterizing the collection of secondary data.

By means of a map, In Loco® demonstrates the percentage of the population that is respecting the isolation recommendation, helping public authorities and research institutes to direct security, communication and health resources. The index is measured by the startup's software and occurs through the percentage of mobile devices that remained within a radius of 450 meters from the location identified as home[6].

In order to obtain the number of new cases of Coronavirus infection in Brazil, the data released by the Ministry of Health were used[7].

The collected content was organized in the Statistical Package for the Social Sciences-SPSS® software and analyzed using descriptive statistics, verifying the correlation among variables, using the Pearson's correlation method. The correlation coefficient (Pearson's ρ) can take values from -1 (negative correlation) to 1 (positive correlation). The closer to the extreme values, the more significant the correlation becomes.

To make the statistical calculation feasible, the 49-day study period was stratified into seven weeks, which originated in the 100th diagnosed case of Covid-19 in Brazil. For each week, the speeds of new cases were calculated using linear regression (logarithm), after the 100th confirmed case. The speed of new cases, or rate of change of Log (NC) over time, is given by the function below.

$$\alpha = \frac{d\,(\text{Log (NC)})}{dt}$$

In each weekly stratum, linear regression of the variables Log (NC) and time, given in days, was performed. Thus, seven linear equations were obtained, as shown below, where a is the linear coefficient, b is the slope of the line and t is the time, given in days.

$$\text{Log (NC)} = a + b.t$$

When applying the derivative of the above equation for the determination in each weekly stratum, the slope

b is numerically equivalent, and this is a constant for each obtained weekly curve.

The speed values of new cases were compared with the average social isolation index (SII). In the equivalent weekly stratum, simple weekly averages of social isolation indices were calculated, as shown in Table 1.

After obtaining the equivalent values, the social isolation indexes (weekly average) and the speeds of new cases (weekly) were compared. For that, a bivariate correlation analysis was performed to obtain Pearson's correlation information, considering a significance level of 0.05.

As this is a research on secondary access data, of a public nature, it was not necessary to present it to the Research Ethics Committee with Human Beings. However, researchers' respect for ethical issues for the development of this research stands out.

■ RESULTS

From the non-linear (exponential) regression of the new cases of Covid-19, Figure 1 was obtained, which shows that the increase in daily cases in Brazil follows an exponential trend. For this period, a determination coefficient (R^2) of 0.879 was observed.

The logarithmic function of the exponential model results in linear models. From the linear regression of the weekly strata obtained, the angular coefficients (speed of new cases) resulted, as shown in Table 1. This table also presents the evolution of new cases of Covid-19 per day, and the social isolation indexes and their simple averages.

The average social isolation and speed index values of new cases were submitted to Pearson's correlation analysis, the result is illustrated in Table 2.

The correlation is significant at the 0.05 level (2 ends), thus, from Table 2, the p-value obtained was 0.022, being less than the significance level of 0.05. Therefore, it indicates that there is a significant correlation among the variables speed of new cases and average SII.

Pearson's correlation coefficient obtained was -0.825, which denotes that there is a high negative correlation between the two variables, that is, as social isolation grows, the speed of new cases decreases.

The dispersion chart presented in Figure 2 shows the correlation between the two variables and makes it easier to visualize the negative correlation between them.

Cases
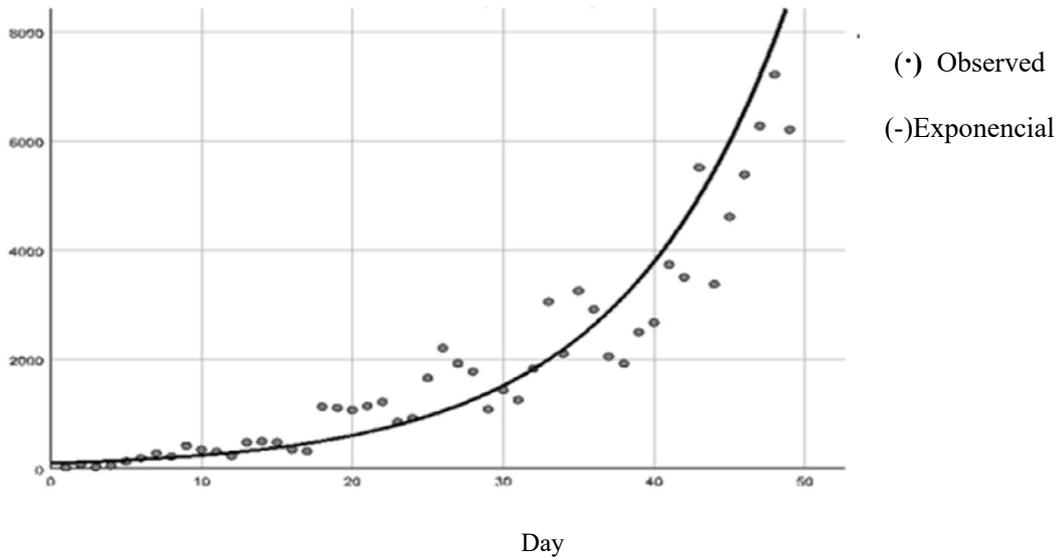
Figure 1 – New cases per day, from the 100th case of Covid-19 in Brazil, 2020
Source: Research data, 2020.

Table 1 – Social isolation index (SII) and number of new and accumulated cases in Brazil from March 14 to May 1, 2020, Brazil

Day	Week	Social Isolation Index	Average Social Isolation Index	New cases of Covid-19 (NC)	Log (NC)	Speed of new cases
1	1	0.37	0.37	23	1.36	1.60
2		0.51		79	1.90	
3		0.39		34	1.53	
4		0.30		57	1.76	
5		0.32		137	2.14	
6		0.35		193	2.29	
7		0.38		283	2.45	
8	2	0.58	0.58	224	2.35	1.48
9		0.70		418	2.62	
10		0.56		345	2.54	
11		0.56		310	2.49	
12		0.57		232	2.37	
13		0.58		482	2.68	
14		0.54		502	2.70	

Table 1 – Cont.

Day	Week	Social Isolation Index	Average Social Isolation Index	New cases of Covid-19 (NC)	Log (NC)	Speedof new cases
15	3	0.56	0.54	486	2.69	2.18
16		0.64		353	2.55	
17		0.52		323	2.51	
18		0.53		1138	3.06	
19		0.47		1117	3.05	
20		0.54		1076	3.03	
21		0.51		1146	3.06	
22	4	0.54	0.53	1222	3.09	2.26
23		0.62		852	2.93	
24		0.51		926	2.97	
25		0.50		1661	3.22	
26		0.49		2210	3.34	
27		0.47		1930	3.29	
28		0.59		1781	3.25	
29	5	0.51	0.51	1089	3.04	2.54
30		0.60		1442	3.16	
31		0.46		1261	3.10	
32		0.52		1832	3.26	
33		0.47		3058	3.49	
34		0.49		2105	3.32	
35		0.49		3257	3.51	

Table 1 – Cont.

| Day	Week	Social Isolation Index	Average Social Isolation Index	New cases of Covid-19 (NC)	Log (NC)	Speedof new cases
36	6	0.51	0.52	2917	3.46	2.32
37		0.62		2055	3.31	
38		0.51		1927	3.28	
39		0.60		2498	3.40	
40		0.48		2678	3.43	
41		0.46		3735	3.57	
42		0.50		3503	3.54	
43	7	0.50	0.50	5514	3.74	2.61
44		0.59		3379	3.53	
45		0.48		4613	3.66	
46		0.50		5385	3.73	
47		0.53		6276	3.80	
48		0.40		7218	3.86	
49		0.53		6209	3.79	

Source: Authors, 2020.

Table 2 – Correlation among the variables of social isolation index and rate of new cases, Brazil, 2020

		Social isolation index	Rate of new cases
Social isolation index	Pearson's correlation	1	-0.825[*]
	Sig. (2 ends)		0.022
	n	7	7
Speed ofnew cases	Pearson's correlation	-0.825[*]	1
	Sig. (2 ends)	0.022	
	n	7	7

Source: Authors, 2020.

Speed of new cases

Social isolation index
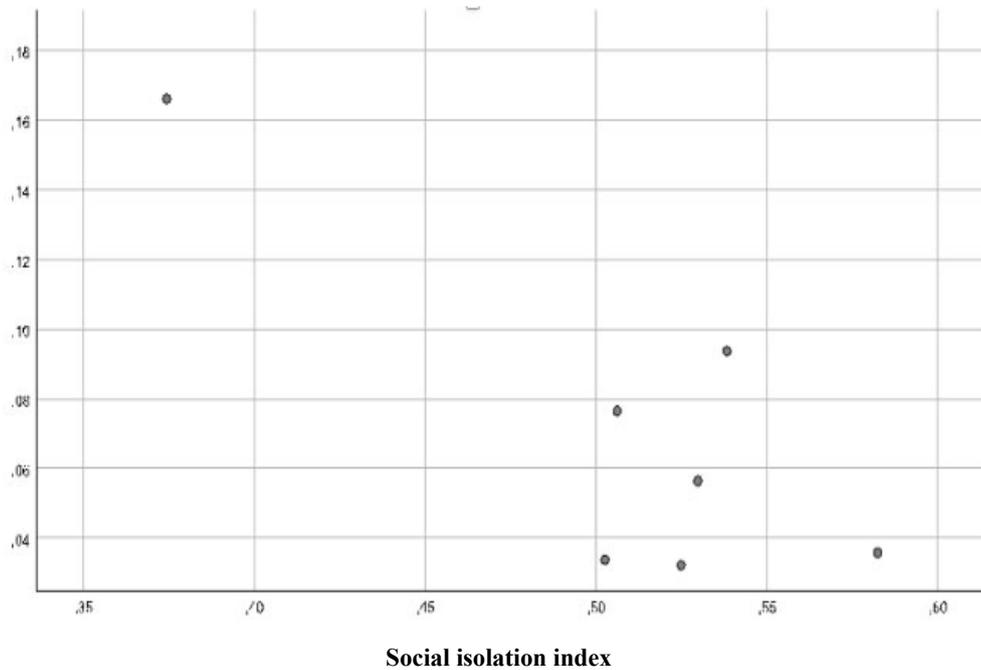
Figure 2 – Dispersion chart between the speed of new cases and social isolation
Source: Research data, 2020.

■ DISCUSSION

With SARS-CoV-2, a new subtype of human severe acute respiratory syndrome (SARS-CoV) emerges, characterized by a high capacity for transmission and induction of severe respiratory infection, generating increasingly intense efforts by health organizations and public power, in containing its advance and dissemination.

The virus is believed to spread mainly from person to person through close contact (the virus can be transferred from the hands to the eyes, nose or mouth) and respiratory droplets (produced when an infected person coughs or sneezes). Transmission of asymptomatic carriers, slightly symptomatic or during the incubation period, estimated between 1 and 14 days[3], may occur.

The new coronavirus promotes acute infection and within 2 to 4 weeks is eliminated by the human body. If the virus does not find a host, the disease ends and the success of the fight depends on the inflection of the pandemic[8].

This scenario touched upon the essential role that nurses and other health professionals play to protect people's health and save lives[9].

Thus, the sustained advance of Covid-19 cases in the world has been accompanied by the formulation of plans for rapid responses to the spread of the disease[10], conducted in large part by professional nurses, who develop actions of primary care, health surveillance, hospital care, among others[5]. These actions include attitudes of early detection, isolation, epidemiological surveillance, prevention and control measures, as well as health impact assessment[11].

Thus, decision-making by health agencies and their professionals is taking place mostly under the non-pharmacological approach[12]. Therefore, the World Health Organization recommended measures of social distancing, respiratory etiquette and hand hygiene as the only and most efficient in combating the Covid-19 pandemic[2]. Thus, nursing, whose object of work is care, promotes guidelines that highlight the need to maintain social isolation as a possibility to deal with the pandemic[13], especially as long as effective pharmacological measures do not exist.

In this perspective, given the role of nurses in care guidelines, constant training is necessary in order to act in line with the best scientific evidence, since the number of publications and information on the new coronavirus is increasing daily. It also serves as an attitude of valorization of the category and its activity in the face of the pandemic scenario, which, coincidentally or not, appears in the year in which the World Health Organization and the Pan American Health Organization celebrate the international year of nursing professionals, through the Nursing Now campaign[14].

Since the middle of March 2020, Brazil has been at the third level of response, which corresponds to the situation in

which there is confirmation of local transmission of Covid-19 in the national territory[11].

Although it is difficult to quantify how many contacts people usually have, the estimates presented help to understand the need for physical isolation, since the data present in this study showed a significant correlation for social isolation, compared to the speed of new cases, corroborating with other research which highlighted the need for a minimum reduction of 75% for symptomatic people and 55% for asymptomatic ones, as the contact reduction rate necessary for better control of transmission[13].

In addition, the exponential increase in the new records observed authenticates the rapid increase in clinical cases of the new disease, conferring the coronavirus as highly transmissible, even though the estimates of the basic reproductive number, reported in the literature, vary widely[13].

Among the reasons that led to the accelerated spread of cases, is globalization and the lack of knowledge to adopt restrictive measures. Thus, the World Health Organization instituted the essential measures to be adopted for the prevention and coping of the disease. Indicating the maintenance of social distance, avoiding agglomerations, and using masks in cases of flu or Covid-19 infection; having the professional nurse, fundamental importance in guiding how to comply with such measures[15].

This growth causes a social impact that echoes the health sector, involving all levels of care, especially those on the frontline of care. Nursing is an example of this, since a 10-day period in April was enough to increase the number of suspected and confirmed Covid-19 cases by 18 times for these professionals. It is up to society, in general, to adhere to attitudes that avoid increasing the number of cases, which at the moment are guided by preventive actions, such as social isolation[16].

The gap is among the government's priorities to decrease the transmission of the virus, minimizing contact between potentially infected and healthy individuals, or between groups with high rates of transmission and/or those with no or low rates. Thus, the importance of social isolation is anchored in the risk that asymptomatic people who remain in the community can infect other people, which makes pandemic control challenging[17].

However, it is important to highlight that, although there is a significant correlation between isolation and the speed of new cases, the strategy of maintaining the separation of people, whether symptomatic or not, may have its effectiveness reduced when transmission occurs before the individual presenting symptoms, due to the difficulty of isolating all cases and tracking contacts[18], which justifies the need to associate isolation with other health and biosafety measures, while there is still no effective treatment.

Therefore, it is worth noting that social isolation actions, by themselves, do not eliminate the virus, but serve as tools in the preparation of services, especially of high complexity, in addition to being a factor in reducing the overburden on nurses and health professionals[16].

It is worth remembering that, in the impossibility of identifying all contaminated cases, there will be no time to delay the transmission of the disease, leading to measures short of isolation, reaching community restraint, which drastically reduce interactions between people and communities[3].

This movement has already been observed in some Brazilian regions, which did not anticipate actions aimed at social isolation, and currently have a high incidence of the disease, such as Sao Paulo, which had its first infection registration on February 26 and initiated isolation measures a month later, on March 24[19]. In addition to the State of Amazonas, which carried out more restrictive suspensions regarding the pandemic, at the end of March, on the 31st, allowing, from this moment on, only essential activities[20].

This does not differ from the other states and territories, since when the measures started to be guided by the health agencies, this did not happen in a uniform manner, and it is up to each administrative body to define and initiate measures, whether for isolation attitudes, health surveillance guidelines or biosafety actions. Maranhão (54.8%), Pernambuco (55.9%), Ceará (55%), Goiás (58.5%) had the best rates of social isolation on April 14, while the States of Tocantins (44.68%) and Mato Grosso do Sul (44.5%) had lower rates in the same period[6].

Considering that the timing of the start of non-pharmacological interventions is decisive in the impact of infection with the Influenza virus[21], for example - especially in a context of doubts about the behavior of the virus - the beginning and duration of isolation measures they need to occur in a sufficient period of time and at the right time, in an attempt to prevent further increases in the number of cases, in order to postpone the apex of the epidemic curve and the demand for health care[22].

Given the facts about the severity of the disease and the intensity of its transmission, the number of new cases and its evolution in Brazil exponentially, the need to prioritize preventive measures of contagion is still justified, especially since there is no vaccine of proven efficacy until this moment.

This situation requires support among administrative bodies to maintain interventions that can mitigate the pandemic[20]. Maintaining, even while studies that prove real effectiveness are still incipient, the use of individual masks[23], whether by symptomatic people or not; in addition

to inducing social distance and environmental measures to clean places and surfaces that promote barriers against the transmission of pathogens[24], given that the virus remains stable outside the human body for a period of 3 days[23].

However, more than preventing the increase of new cases of the disease in the country, it is expected that isolation measures will reverberate in the capacity of the health system, as while new contamination occurs, given the lethality of the disease that requires mechanical ventilation hospital support[3], the hospital level is overburdened, and this reflection encourages other studies that associate the period when social isolation began, in different scenarios, to the occupancy speed of the hospital system to serve Covid-19.

■ CONCLUSION

This study showed that the increase in the number of new cases of Covid-19 behaves exponentially.

Furthermore, measures of social isolation have significant effects on the speed of new cases by Covid-19 in the population, with a high negative correlation among the variables (Pearson's $\rho = -0.825$).

Therefore, the evidence pointed out supports the health and nursing team on strategies to prevent Covid-19, contributing to government and health team decisions regarding adherence to social isolation measures, as an important tool to reduce new cases of Covid-19.

The provision of data being from a secondary source is a limitation of the study.

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