The Progression Of COVID-19 In Santa Catarina: Epidemiological Indicators And Normative Measures During The First Three Semesters Of The Pandemic

A Progressão da Covid-19 Em Santa Catarina: Indicadores Epidemiológicos e Medidas Normativas nos Três Primeiros Semestres da Pandemia

La Progresión Del COVID-19 En Santa Catarina:indicadores Epidemiológicos y Medidas Normativas En Los Tres Semestres de La Pandemia

RESUMO

INTRODUÇÃO: O objetivo deste estudo foi descrever os indicadores epidemiológicos e os decretos estaduais relacionados à COVID-19 nos três primeiros semestres da pandemia em Santa Catarina, Brasil. MÉTODOS: Foi realizado um estudo ecológico que dividiu o período de 1° de janeiro de 2020 a 30 junho de 2021 em três semestres, retratando a evolução epidemiológica da COVID-19 e sua relação com os decretos estaduais sobre distanciamento social. O conteúdo dos decretos foi agrupado em categorias para posterior análise de sua repercussão. RESULTADOS: No período, registraram-se 1.064.044 casos confirmados de COVID-19, a maior proporção (50,7%) destes foi observada no primeiro semestre de 2021, quando houve também maior número de restrições (n=43), a maioria delas adotada após aumento no número de casos. Dez flexibilizações antecederam a primeira onda da doença e sete antecederam a terceira. CONCLUSÃO: Observou-se que as medidas de flexibilização do distanciamento social foram adotadas de maneira precoce e abrupta, bem como as restrições não foram implementadas habilmente para evitar novas ondas da doença.

DESCRITORES: Infecções por Coronavírus; COVID-19; Mortalidade; Decretos; Legislação; Distanciamento Social.

ABSTRACT

INTRODUCTION: The aim of this study was to describe the epidemiological indicators and state decrees related to COVID-19 in the first three semesters of the pandemic in Santa Catarina, Brazil. METHOD: An ecological study was carried out that divided the period from January 1, 2020 to June 30, 2021 into three semesters, portraying the epidemiological evolution of COVID-19 and its relationship with state decrees on social distancing. The content of the decrees was grouped into categories for later analysis of their repercussions. RESULTS: During the period, 1,064,044 confirmed cases of COVID-19 were recorded, the largest proportion (50.7%) of which was observed in the first semester of 2021, when there was also a greater number of restrictions (n=43), most of them adopted after an increase in the number of cases. Ten relaxations preceded the first wave of the disease and seven preceded the third. CONCLUSION: It was observed that the measures to relax social distancing were adopted early and abruptly, and that the restrictions were not implemented skillfully to prevent new waves of the disease.

DESCRIPTORS: Coronavirus Infections; COVID-19; Mortality; Decrees; Legislation; Social Distancing.

RESUMEN

INTRODUCCIÓN: El objetivo de este estudio fue describir los indicadores epidemiológicos y decretos estatales relacionados con el COVID-19 en los primeros tres semestres de la pandemia en Santa Catarina, Brasil. MÉTODOS: Se realizó un estudio ecológico que dividió el período del 1 de enero de 2020 al 30 de junio de 2021 en tres semestres, retratando la evolución epidemiológica del COVID-19 y su relación con los decretos estatales sobre distanciamiento social. El contenido de los decretos fue agrupado en categorías para el posterior análisis de su impacto. RESULTADOS: Durante el período se registraron 1.064.044 casos confirmados de COVID-19, la mayor proporción (50,7%) de estos se observó en el primer semestre de 2021, cuando también hubo un mayor número de restricciones (n=43), el la mayoría de ellos se implementaron después de un aumento en el número de casos. Diez relajaciones precedieron a la primera ola de la enfermedad y siete a la tercera. CONCLUSIÓN: Se observó que las medidas para relajar el distanciamiento social se adoptaron temprana y abruptamente, y que las restricciones no fueron aprobadas hábilmente para prevenir nuevas olas de la enfermedad.

DESCRIPTORES: Infecciones por Coronavirus; COVID-19; Mortalidad; Decretos; Legislación; Distanciamiento social.

RECEIVED: 08/22/2024 **APPROVED:** 09/20/2024

How to cite this article: Ronsoni KF, Hughes HMFRB, Carneiro RAVD, Silva CJT, Oliveira LP, Hillesheim D, Cascaes AM, Hallal ALC. The Progression Of COVID-19 In Santa Catarina: Epidemiological Indicators And Normative Measures During The First Three Semesters Of The Pandemi**c** . Saúde Coletiva (Edição Brasileira) [Internet]. 2025 [acesso ano mês dia];15(92):13865-13872. Disponível em: DOI: 10.36489/saudecoletiva.2025v15i92p13865-13872

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INTRODUÇÃO

As of February 25, 2020, when the first case of infection by the SARS-CoV 2 virus was identified in Brazil, a public health crisis situation can be observed progressively taking hold. [1] After one year and four months of this event, at the end of June 2021, the country reached the mark of 514,092 deaths from the disease [2], placing itself as the third country in the world with the highest number of accumulated cases of COVID-19. [3] In this context, the beginning of 2021 was marked by the second wave of the disease in Brazil, characterized by an increase in the number of cases and deaths not observed even during the first wave of COVID-19 that unfolded between July and August 2020. [1] As a consequence, there was a considerable increase in the demand for health services. [1]

The health crisis that the country has been going through has intensified due to political issues, as, throughout the pandemic, the Federal Government has been resistant to adopting a uniform and integrated fight against COVID-19 throughout the Brazilian territory [4,5], as well as encouraging treatments and health measures that had no scientific basis. [6] Furthermore, the identification of the new P1 variant in January 2021 was yet another aggravating factor. [5]

Thus, the promotion of social distancing measures, recognized as effective in preventing the spread of communicable diseases [4], became the main tool for controlling the number of cases and deaths from the disease, and were put into practice mainly at the state and municipal levels through decrees regulated by Federal Law 13,979 in 2020. [7]

The state of Santa Catarina, which in the last week of April 2021 occupied 4th place in the national ranking of Federative Units with the highest number of cases per 100,000 inhabitants [8], after an increase in the number of cases between July and August 2020 and a subsequent slowdown in the spread of the disease in September and October, there was a new increase in the number of people infected with SARS-CoV-2 at the end of the same year. 8 Throughout this period, despite calls from the scientific community to maintain social isolation, there was a constant relaxation of public isolation measures. [8]

In a study carried out in the city of Florianópolis in 2020, with the aim of analyzing whether there was consonance between the municipal decrees related to COVID-19 and the epidemiological indi-

DOI: 10.36489/saudecoletiva.2025v15i92p13865-13872

cators of the disease, it was concluded that there was a contradiction between both. [9] In another survey also carried out in 2020, which related COVID-19 indicators in the state of Santa Catarina and state decrees regarding social distancing measures, a similar conclusion was reached. [10]

Given this context, the objective of this study was to describe the epidemiological indicators and state decrees related to COVID-19 in the first three semesters of the pandemic in Santa Catarina, Brazil.

METHODS

An ecological study was conducted using the state of Santa Catarina as the unit of analysis, from January 1, 2020 to June 30, 2021, a time period relative to the beginning and developments of the COVID-19 pandemic in Brazil. For analysis purposes, the period was divided into three semesters: from January 1, 2020 to June 30, 2020, from July 1, 2020 to December 31, 2020, and from January 1, 2021 to June 30, 2021.

To extract cases and deaths in the state, the Santa Catarina open data portal was consulted [11], on November 30, 2021, considering only cases and deaths with laboratory confirmation of SARS-CoV-2 infection. Information regarding the resident population was obtained from the website of the Information Technology Department of the Unified Health System, considering the projection of the population of Santa Catarina estimated by the Brazilian Institute of Geography and Statistics (IBGE), for the years 2020 and 2021. The indicators analyzed were: Number of new cases (according to the date of onset of symptoms); Number of deaths in the last 24 hours (according to the date of death); Mortality rate; Incidence rate.

The incidence and mortality rates were obtained by dividing the number of new cases and the number of deaths, respectively, by the resident population estimated by the IBGE for the same period, multiplying by 100,000 inhabitants. The data were described by semester and analyzed using Microsoft Excel and Stata 14 software.

Next, the state decrees issued by the government of Santa Catarina related to the public health emergency due to COVID-19 during the aforementioned period (Federal Law 13,979/2020) were analyzed in full and in the temporal order of issuance. These decrees were also accessed on the state's open data platform11, seeking those that dealt with the issues of social distancing in its multiple forms. Based on their content and previous studies [10], The categories affected by the social distancing measures adopted can be classified into 15 items: a. In-person education: Includes educational levels from primary to higher education, in addition to education for young adults, technical education and public training; b. Trade in non-essential food and beverages: Includes restaurants, bars and other establishments supplying non-essential food and beverages; c. Transportation of people: Includes air, land or water transportation; d. Hotel chain: Includes hotels, inns and other forms of paid accommodation; e. Trade in products: Includes trade in non-food and non-essential products in general; f. Trade in essential foods: Includes supermarkets, markets, grocery stores, bakeries, butchers and fishmongers; g. Staying in squares and public places: Includes public spaces for collective use such as beaches, parks and squares; h. Religious services: Includes religious services and masses; i. Crowds of people: Includes any regulation on the subject, whether or not specified by the author, as long as the term is literally mentioned; j. Gyms: Includes gyms and training centers; k. Nightclubs: Includes nightclubs and concert halls; l. Cinemas and theaters: Includes cinemas and theaters in public and private spaces; m. Scientific and cultural events: Includes fairs, exhibitions, congresses, seminars and lectures of a public or private nature; n. Sports competitions: Includes the calendar of the Santa Catarina Sports Foundation (FESPORTE) and private competitions; o. Recreational complexes: Includes theme parks and zoos.

Considering each of the categories mentioned, the content of the social distancing measures implemented in each of the decrees was analyzed, which were classified into three groups according to their impact when compared to the previous decree: a. Restriction: Impact caused by a decree whose text presents initial restrictive measures for the category or measures whose restrictive effects exceed those in force previously. Restrictive decrees with a predetermined duration of less than 5 days were also included in this category. b. Maintenance: Considered when a new decree extends the term of validity of restrictive measures of previous decrees, with production of the same effects. c. Flexibilization: Category intended for decrees whose impact of the restrictive content is perceived to be reduced in relation to the previous decree; or to the decree that expires the term of validity of the previous one, without adding new restrictions.

After classifying the impact of the decrees into the previously defined categories, the number of restrictions, maintenances and flexibilities in each of the 18 months of the analyzed period were counted, as well as the sum of these in each of the semesters under study. For analysis purposes, only restrictive and flexibilization decrees were presented in the results.

Considering that the data used to conduct the research are in the public domain and corroborate Resolution 510 of April 17, 2016 of the National Health Council, there was no need to submit the work to the Ethics Committee for Research with Human Beings.

RESULTS

In the first three semesters of the pandemic, there were 1,064,044 cases and 13,430 deaths in the state, confirmed in the laboratory for COVID-19. The first semester of 2021 presented the highest incidence and mortality rates, with 7,358.2 cases and 116.9 deaths per 100,000 inhabitants, respectively. Regarding the decrees analyzed, during the first semester of 2021, 43 restrictions and 22 flexibilities were issued, while the second semester of 2020 presented lower numbers for both classifications (n=7).

DOI: 10.36489/saudecoletiva.2025v15i92p13865-13872

Table 1. Description of epidemiological indicators and restrictive and flexibilization decrees in the first three semesters of the COVID-19 pandemic. Santa Catarina, 2020-2021.

Indicators	1st semester of 2020	2nd semester of 2020	1st semester of 2021
Number of cases	*48.029*	*476.032*	*539.983*
Number of deaths	*377*	*4.471*	*8.582*
Incidence rate*	*662,2*	*6563,7*	*7358,2*
Mortality rate*	*5,2*	*61,6*	*116,9*
Number of restrictions	*24*	*7*	*43*
Number of flexibilization	*10*	*7*	*22*

*Calculated per 100,000 inhabitants.

A total of 62 state decrees related to the public health emergency caused by COVID-19 were analyzed, including 6 legislative decrees and 46 executive decrees. Regarding their content, only 32 of them addressed social distancing measures relevant to this study. Regarding the distribution in the three semesters under analysis, a total of 24 decrees were published in the first semester, 15 decrees in the second semester, and 23 in the third. During the first semester of 2020, it is worth noting that 23 of the 24 documented restrictions occurred during the month of March, so the subsequent months had only one restriction. During the second semester of 2020, there were fewer restrictions and relaxations, with most of them occurring during the month of December. The third semester of the pandemic saw the highest number of restrictions observed; the first of them was issued on February 25, 2021. Of the restrictions, 20 were limited in nature, lasting less than 5 days. Regarding flexibilities, 18 out of a total of 22 took place during the month of April 2021. (Board 1).

Of all the 18 months analyzed, March 2020 was the month with the highest number of restrictions in the categories in question. April 2021 was the month with the highest number of relaxations.

<Board 1>

DOI: 10.36489/saudecoletiva.2025v15i92p13865-13872

Board 1. Description of state decrees related to COVID-19 by semester, publication month, and activity grouping categories in Santa Catarina, up to June 2021.

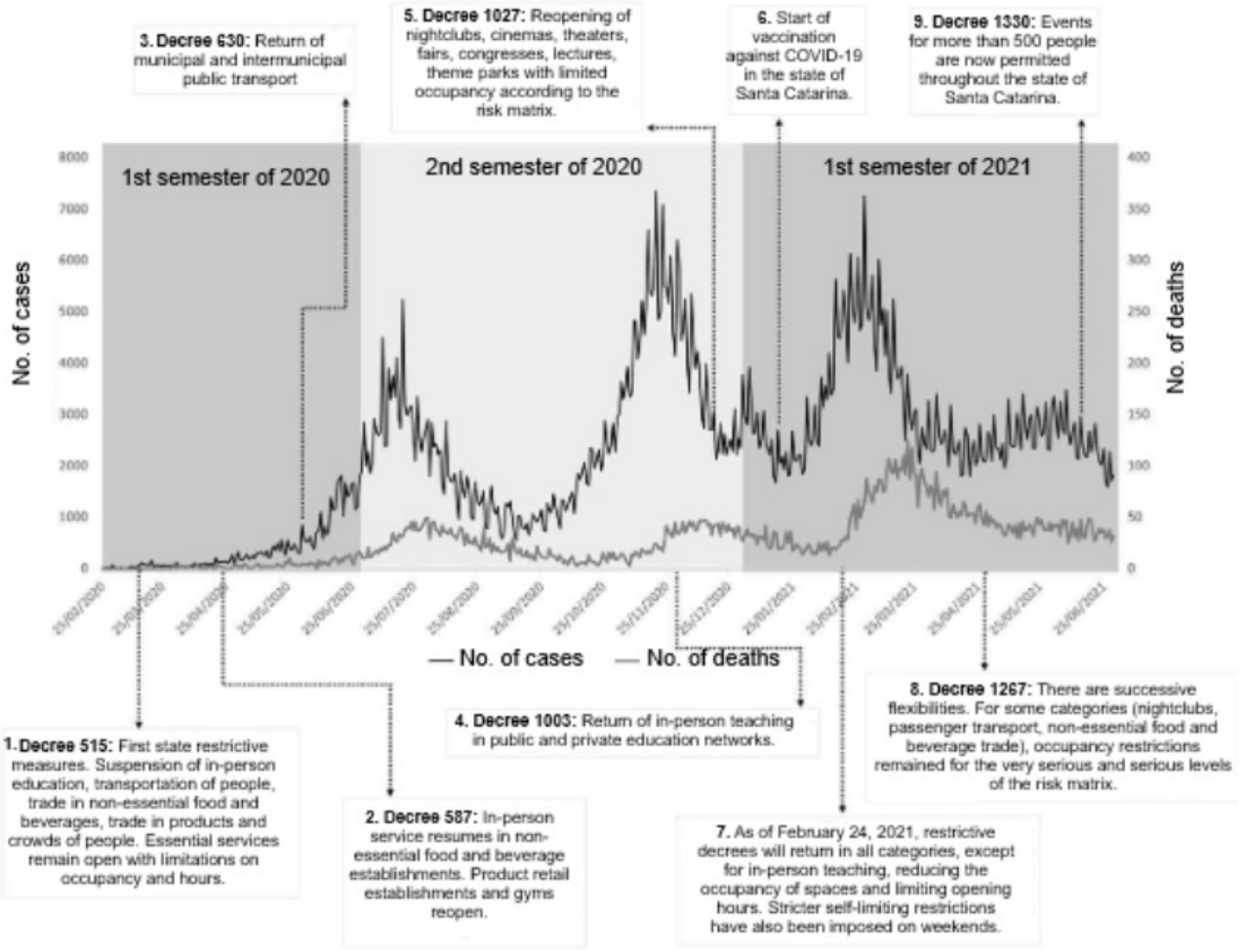
Month of publication	Jan	Feb	Mar		Apr		May	Jun		Jul		Aug		Sep	Oct	Nov	Dec		Jan	Feb		Mar		Apr		May		Jun	
Category/ Repercussion	x	x	R	F	R	F	x	R	F	R	F	R	F	x	x	x	R	F	x	R	F	R	F	R	F	R	F	R	F
In-person teaching			2	0	0	0		0	1	0	0	0	0				0	1		0	1	0	0	0	0	0	0	0	0
Non-essential food and beverage trade			2	0	0	2		0	0	0	0	0	0				1	0		2*	0	2*	0	0	3	1	0	0	0
Transportation of people			2	0	0	0		0	1	1	0	0	0				1	0		1	0	0	0	0	1	0	0	0	0
Hotels			1	0	0	1		0	0	0	0	0	0				0	1		0	0	1	0	0	1	0	0	0	0
Sale of products			1	0	0	1		0	0	0	0	0	0				0	0		2*	0	2*	1	0	1	0	0	0	0
Sale of essential foods			1	0	0	0		0	0	0	0	0	0				0	0		0	0	1	1	0	0	0	0	0	0
Squares and public places			1	0	0	0		0	0	1	0	0	0				1	0		1*	1	2*	0	0	1	0	0	0	0
Religious cults			1	0	0	1		0	0	0	0	0	0				1	0		2*	0	1	0	0	1	0	0	0	0
Crowd of people			1	0	1	1		0	1	0	0	0	0				1	1		2*	0	2*	0	0	1	0	1	0	1
Nightclubs			2	0	0	0		0	0	0	0	0	0				0	1		1	0	1*	0	0	1	0	0	0	0
Cinemas and theaters			2	0	0	0		0	0	0	0	0	0				0	1		2*	0	2*	0	0	1	0	0	0	0
Fairs, conferences and lectures			2	0	0	0		0	0	0	0	0	0				0	1		2*	0	2*	0	0	1	0	0	0	0
Sports competitions			2	0	0	0		0	0	0	0	0	0				0	1		1*	0	2*	0	0	1	0	0	0	0
Theme parks and zoos			2	0	0	0		0	0	0	0	0	0				0	0		2*	0	2*	0	0	1	0	0	0	0
Gyms			1	0	0	1		0	0	0	0	0	0				0	0		2*	0	2*	0	0	1	0	1	0	0
Total	x	x	23	0	1	7	x	0	3	2	0	0	0	x	x	x	5	7	x	20	2	22	2	0	15	1	2	0	1
Total no semestre	24 restrições				10 flexibilizações					7 restrições					7 flexibilizações				43 restrições					22 flexibilizações				

Before the first peak of cases in Santa Catarina, decrees 587 and 630 authorized the return of several activities, including public transportation and in-person service in non-essential food and beverage establishments. On November 20, 2020, a record number of daily cases of the disease was recorded, with 7,354 notifications, representing an incidence rate of 101.4 cases per 100,000 inhabitants on that date. On December 14, 2020, while the curve of cases decreased in the state, in-person teaching was resumed in public and private schools (Figure 1).

On December 18, 2020, nightclubs, cinemas, theaters, fairs, conferences, lectures, and theme parks reopened, but with limited occupancy. In January 2021, vaccination against COVID-19 began in the state, and despite this major milestone, the first half of that year saw the third peak in cases and deaths (7,249 notifications on March 1, 2021). Successive relaxations occurred from May 2021 onwards (Figure1).

DOI: 10.36489/saudecoletiva.2025v15i92p13865-13872

Figure 1. Temporal evolution of the number of COVID-19 cases and deaths in the state, as well as key milestones in the three semesters analyzed. Santa Catarina, 2020-2021.



DISCUSSION

The pattern observed in this study, referring to the state of Santa Catarina, which consists of a significant increase in the number of cases and deaths from COVID-19 after measures to relax social distancing, was observed in other studies. [12,13] In this study, three moments were observed that stand out in relation to the increase in the number of registered cases and deaths. In the months of July and August 2020, the increase in the number of daily cases was preceded by ten relaxations between April and June. In the second moment observed, between October and December 2020, only two restrictions were observed preceding the peak observed in the curve, which occurred in the month of July. In the third moment in question, which occurred between the months of January and March 2021, seven relaxations were observed throughout the month of December 2020. It is noteworthy that the aforementioned finding of three peaks in the curve of the number of daily cases and deaths of COVID-19 throughout the studied period was a difference from what is found in the literature on the subject, which deals with the occurrence of two waves of the disease in Brazil as well as in Santa Catarina. [1,8]

In a study conducted in France, which sought to define the effectiveness of social isolation in reducing the number of COVID-19 cases by comparing nine countries, it was found that, together with social distancing measures applied early, a gradual deconfinement prevents a long plateau in the curve of the number of COVID-19 cases; while an abrupt deconfinement, as observed in Santa Catarina, where numerous services and establishments were reopened at the same time, becomes less effective in controlling the

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disease. [13]

The development and improvement of mathematical models that measure the effectiveness of social distancing measures in reducing the transmission of COVID-19 became a key part of combating the disease as it began to be seen as a threat to public health worldwide. [14,15] From such models, systematic studies were able to practically analyze the results of social distancing. [14] In 2020, researchers applied a mathematical model to 134 countries and observed that in those where isolation measures were implemented, there was a 65% decrease in new cases of COVID-19 in two weeks. 14 Another study, conducted in the United Kingdom, demonstrated a direct impact of government measures to reduce population mobility on reducing the number of deaths from COVID-19 in 18 days when compared to the predicted value. [16]

In this context, when analyzing social distancing measures in South Korea, in addition to there being a positive correlation between social isolation and the reduction in the transmission of SARS-CoV-2, it was also observed that a period of at least ten days is necessary for the results of distancing to be achieved. [17] In Great Britain, the application of a mathematical simulation model to evaluate non-pharmacological interventions to reduce the number of cases and deaths from SARS-CoV-2 demonstrated that the combination of isolation of positive cases, quarantine and social distancing of the population at risk is an effective combination, requiring its introduction two to three weeks in advance for the results to be observed in the hospital context. [18]

In a descriptive analysis of social distancing measures in different Brazilian states, Santa Catarina was among those that most quickly adopted the so-called "economic lockdown", related to the partial suspension of non-essential activities, and such measures were established between the first and tenth cases of COVID-19 reported in the state. [19] Other states, including Rio Grande do Sul, established a total "economic lockdown" within the same epidemiological interval, and the state of São Paulo only adopted a partial "economic lockdown" between the 11th and 50th cases of COVID-19. [19]

The Brazilian response to the pandemic caused by SARS-Cov-2 was based mainly on state and municipal interventions and received little support at the federal level. [4,5] According to a model created to track global government responses to COVID-19 developed by the University of Oxford, [20] on November 25, 2020, when the number of daily cases of the disease was increasing in Santa Catarina, the government's strictness index was 57.87 on a scale of 1 to 100, with 100 being the maximum score. On February 25, 2021, the index rose to 73.61, a fact that is in line with the 21 restrictions observed throughout the same month in the state of Santa Catarina. [20]

The development of a pandemic follows different patterns depending on the location analyzed and its spatial, social and economic characteristics, a fact that must be taken into account when making political decisions. [21,22] In the state of São Paulo, it was noted that the transmission trend of SARS-CoV-2 followed two patterns, going from metropolitan areas to the interior of the state and also from urban centers of regional relevance to municipalities with fewer connections. 21 This fact reinforces the need for social distancing measures to be adopted early in large urban conglomerates and gradually relaxed. [21] In Florianópolis, the capital of Santa Catarina and an economically important urban center connected to other municipalities, when analyzing political decision-making and its relationship with the spread of COVID-19, it was observed that between June and July 2020, months that showed the greatest expansion in the number of cases and deaths from the disease throughout the period studied, there was also the greatest presence of municipal decrees that were not consistent with the epidemiological situation. [9]

> "With the pandemic situation extending for months, a phenomenon called "pandemic fatigue", related to the population's decreased adherence to the social distancing measures adopted, has become common in Brazil. [23]"

This fact, when combined with the emergence of new variants of SARS-CoV-2, the many relaxations after the first peak in the number of COVID-19 cases in July 2020, and the absence of a considerable number of new restrictions, culminated in the new waves of COVID-19 in Brazil and Santa Catarina. The second half of 2020 was the one with the fewest relaxations and restrictions, with seven in each category, reflecting a state of political stagnation until a new increase in the number of cases in October. In addition, the stricter restriction measures adopted after the increase in the number of cases and deaths from COVID-19 between November 2020 and March 2021, with the aim of containing the unfavorable epidemiological evolution, had the particularity of having a predetermined duration of less than five days, most of them being valid only on weekends. In a 2020 study that sought to investigate determining factors in the levels of social distancing recorded in Brazilian states, it was noted

DOI: 10.36489/saudecoletiva.2025v15i92p13865-13872

that the longer the duration of restrictive measures, the lower the adherence to distancing, corroborating the phenomenon of "pandemic fatigue". [24]

This study has some limitations, including the dependence on the availability of tests for the correct diagnosis of COVID-19 cases, as well as on teams trained to perform them. The start of vaccination against SARS-CoV-2 in January 2021 is a factor not analyzed in this study and has great potential to change the curves of the number of cases and deaths from the disease. The importance of the quality of the secondary data used is also mentioned, so that the analysis becomes credible. In addition, by classifying the repercussions of the decrees analyzed into only three categories, the nuances of each of the measures implemented are lost; thus, decrees that culminate in flexibilities and restrictions with very different relevance within the context were classified in the same way.

CONCLUSIONS

It is concluded that the implementation of early and abrupt easing measures, as well as the failure to adopt restrictive measures in a timely manner to reduce the number of cases and deaths from COVID-19, culminated in the three "waves" that characterize the pandemic in Santa Catarina. The state's political decision-making at an inopportune time, together with the population's desensitization to the severity of the epidemiological situation, both having as a "backdrop" the absence of a national policy to combat SARS-CoV-2, are cited as driving forces behind the alarming situation observed at the beginning of 2021, at which time the state reached numbers of daily cases and deaths not previously observed.

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DOI: 10.36489/saudecoletiva.2025v15i92p13865-13872