



Impact of COVID-19 Pandemic on Vaccine Coverages in Brazilian States

O Impacto da Pandemia de COVID-19 nas Coberturas Vacinais dos Estados Brasileiros

Impacto de la Pandemia de Covid-19 en las Coberturas de Vacunación de los Estados Brasileños

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ABSTRACT

Objective: Assess the impact of the COVID-19 pandemic on general vaccination coverage indicators in Brazilian states. **Methods:** A descriptive ecological time series study with Brazilian federative states and general vaccination coverage between 2013 and 2021 was carried out as the unit of analysis. Data were collected in the National Immunization Program Information System via DATASUS, processed, and analyzed in Microsoft Office Excel software. The descriptive statistical analysis comprised the calculations of measures of central tendency and dispersion, in addition to the difference and percentage variation, considering the changes in the historical series, with a comparison between the period before the pandemic (2018-2019) and the pandemic period (2020-2021). **Results:** All Brazilian states reduced overall vaccination coverage during the COVID-19 pandemic compared to previous years. The variation in the decline in vaccination coverage presented inequalities between states, understood as health inequities. Considering the general average and the declining percentage during the pandemic, the states in the best relative situation are Santa Catarina, Tocantins, Distrito Federal, Minas Gerais, Paraná, and Mato Grosso. The worst situations are Amapá, Rio de Janeiro, and Acre. **Conclusion:** The pandemic impacted on the vaccination coverage coefficients in Brazilian states resulting in regional inequalities. The study contributes to understanding the immunization scenario in the country despite the limitations intrinsic to the ecological nature of the approach. The revitalization of the National Immunization Program requires joint efforts from society, including health education actions and improvement of financing and management processes.

Descriptors: Immunization; Vaccination Coverage; COVID-19; Health Inequities

RESUMO

Objetivo: Avaliar o impacto da pandemia de COVID-19 nos indicadores de cobertura vacinal geral dos estados brasileiros. **Métodos:** Estudo ecológico descritivo de série temporal, tendo como unidade de análise os estados federativos brasileiros e as coberturas vacinais gerais entre 2013 e 2021. Os dados foram coletados no Sistema de Informação do Programa Nacional de Imunização, via DATASUS, processados e analisados no software Microsoft Office Excel. A análise estatística descritiva compreendeu os cálculos de medidas de tendência central e de dispersão, além da diferença e variação de percentual, considerando as modificações na série histórica, com comparação entre o período anterior à pandemia (2018-2019) e o período de pandemia (2020-2021). **Resultados:** Todos os estados brasileiros reduziram a cobertura vacinal geral durante pandemia de COVID-19, em relação aos anos anteriores. A variação de cobertura vacinal apresentou desigualdades entre os estados, compreendidas enquanto iniquidades em saúde. Considerando a média geral e o percentual de queda durante a pandemia, os estados em melhor situação relativa são: Santa Catarina, Tocantins, Distrito Federal, Minas Gerais, Paraná e Mato Grosso. Já em pior situação relativa são: Amapá, Rio de Janeiro e Acre. **Conclusão:** A pandemia apresentou impactos nos coeficientes de cobertura vacinal dos estados brasileiros, reproduzindo desigualdades regionais. O estudo contribui para compreensão do cenário da imunização no país, apesar das limitações intrínsecas ao caráter ecológico da abordagem. A revitalização do Programa Nacional de Imunização requer esforços conjuntos da sociedade, incluindo ações de educação em saúde e aprimoramento de processos de financiamento e gestão.

Descritores: Imunização; Cobertura Vacinal; COVID-19; Iniquidades em Saúde.



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RESUMEN

Objetivo: Evaluar el impacto de la pandemia de Covid-19 en los indicadores de cobertura de vacunación general de los estados brasileños. **Métodos:** Estudio ecológico descriptivo e serie temporal, teniendo como unidad de análisis los estados federativos brasileños y las coberturas de vacunación general entre 2013 y 2021. Los datos fueron colectados en el Sistema de Información del Programa Nacional de Inmunización, vía DATASUS, procesados y analizados en el software Microsoft Office Excel. El análisis estadístico descriptivo comprendió los cálculos de medidas de tendencia central y de dispersión, además de la diferencia y variación porcentual, considerando las modificaciones en la serie histórica, con comparación entre el periodo anterior a la pandemia (2018-2019) y el periodo de pandemia (2020-2021). **Resultados:** Todos los estados brasileños redujeron la cobertura de vacunación general en la pandemia de Covid-19, en relación a los años anteriores. La variación de caída de la cobertura de vacunación presentó desigualdades entre los estados, comprendidas mientras inequidades en salud. Considerando la media general y el porcentual de caída durante la pandemia, los estados en mejor situación relativa son: Santa Catarina, Tocantins, Distrito Federal, Minas Gerais, Paraná, y Mato Grosso y en peor situación relativa son: Amapá, Río de Janeiro e Acre. **Conclusión:** La pandemia presentó impactos en los coeficientes de cobertura de vacunación de los estados brasileños, reproduciendo desigualdades regionales. El estudio contribuye para la comprensión del escenario de la inmunización en el país, a pesar de las limitaciones inherentes al carácter ecológico del enfoque. La revitalización del Programa Nacional de Inmunización requiere esfuerzos conjuntos de la sociedad, incluyendo acciones de educación en salud y mejoramiento de procesos de financiación y gestión.

Descriptor: Inmunización; Cobertura de vacunación; Covid-19; Inequidades en salud.

INTRODUÇÃO

Vaccination or immunization is one of the most efficient measures in preventing infectious diseases and controlling the proliferation of epidemics, having positive and multisectoral impacts on the public health of the entire population. Immunization is a cost-effective health investment that prevents deaths and increases global life expectancy⁽¹⁾.

The Brazilian population has been vaccinated in public health actions for over a century. In 1973, as a milestone for consolidating and strengthening vaccination actions in Brazil, the National Immunization Program (PNI) was created to control vaccine-preventable diseases through the strategy of organizing actions in the sector, which included the expansion of the vaccination network, especially in rural and difficult-to-access areas, epidemiological surveillance, health education, the establishment of national laboratories and quality control of vaccines⁽²⁾. With the PNI, from 2004 onwards, the Brazilian scenario began to gain global prominence in vaccine-preventable disease eradication and control. In addition to supplying and distributing vaccines in the national territory, Brazil started to export immunobiological, with emphasis on the African continent⁽³⁾.

The PNI has leveraged relevant advances in public health in Brazil and currently offers vaccines recommended by the World Health Organization (WHO), free of charge, through the Unified Health System (SUS) to all age groups through national vaccination calendars⁽⁴⁾. PNI efficacy and effectiveness are measured based on the vaccination coverage of the Brazilian population, which is a reliable health indicator⁽⁵⁾. Vaccination coverage (VC) is calculated by dividing the dose number applied by the target population in a given territory and period, multiplied by one hundred⁽⁴⁾.

Since February 2020, the routine of the Brazilian population has changed significantly due to the COVID-19 pandemic, a public health emergency declared by the Ministry of Health through ordinance number 188 of February 3, 2020⁽⁶⁾. The new coronavirus pandemic has triggered global efforts to control it, with protective measures that include the use of masks, hand sanitization, restrictions on human contact, social isolation, and development of vaccines. Such protective measures to mitigate the new health emergency may be related to a decrease in demand for health services by the Brazilian population, including primary routine vaccination, as has been evidenced in other service sectors⁽⁷⁾.

The health promotion policy, as a whole, suffered severe impacts during the pandemic, with the weakening of social, economic, and environmental conditions and access to information by the population⁽⁸⁾. Therefore, the COVID-19 pandemic created a favorable scenario for deepening health inequities and systematic and impactful health inequalities that are avoidable, unnecessary, and unfair^(9,10).

In this context, this study's objective was to assess the impact of the COVID-19 pandemic on general vaccination coverage indicators in Brazilian states.

METHODS

It is a descriptive ecological study⁽¹¹⁾ of a time series covering the entire Brazilian territory, the 27 federative units, and the Regions of Brazil from 2013 to 2021, using the general vaccination coverage of the basic vaccination calendar. The period incorporated in the study (2013-2021) corresponds to the period before the COVID-19 pandemic (2013-2019) and the pandemic period (2020-2021), providing a temporal reference for analyzing the impacts of the pandemic on vaccination coverage.

Vaccination coverage data was collected from the National Immunization Program Information System (SI-PNI), organized by the PNI General Coordination (CGPNI) and available through a public domain database by the SUS Information Technology Department (DATASUS)⁽¹²⁾ on the official website in August 2022, which constituted the data collection period. The variables collected were VC, year, and Federation Unit. The choice of such variables is justified by enabling the achievement of the study objective, as it allows the temporal and spatial analysis of variation in vaccination coverage before and during the COVID-19 pandemic.

According to the technical note available on the DATASUS platform, the VC calculation is carried out by dividing the number of vaccines applied by the number of individuals present in the target population and multiplying the result by 100. This calculation is carried out directly by the platform⁽¹³⁾.

All data were collected via DATASUS⁽¹²⁾, stored, and processed using statistical tools in Microsoft Office Excel® software, version 2016. The descriptive statistical analysis comprised the calculations of measures of central tendency (means) and dispersion (standard deviation), as well as percentage difference and percentage variation, considering changes in VC throughout the historical series, with a comparison between the period immediately before the pandemic (2018-2019) and the pandemic period (2020-2021). The data is presented in tables, maps, and graphs to facilitate visualization and comparison, with the VC of the Regions and Federation Units, considering the COVID-19 Pandemic as a temporal event of analytical importance during the study period.

The study followed the ethical precepts in research set out in Resolution No. 466 of December 2012⁽¹⁴⁾ and, as it used a public domain database, without the possibility of individual identification, there was no need for evaluation and approval by the Research Ethics Committee.

RESULTS

Initially, the VC coefficients of the Brazilian states are presented considering the years 2013 to 2021, followed by an analysis of the VC variation based on the country regions. Subsequently, the impact of the COVID-19 pandemic is presented through a comparison between the two years immediately preceding the pandemic (2018-2019) and the first two years of the pandemic (2020-2021). Finally, a summary of the results is presented considering the situation of the states concerning the historical average (2013-2021) and the variation in vaccination coverage during the pandemic (comparison of the average of 2018-2019 and 2020-2021).

Table I presents the VC coefficients of the Brazilian states from 2013 to 2021, as well as the mean and standard deviation (SD) calculations. In general, it appears that the VC was unstable during the period. The lowest VC coefficient was 41.43% (Pará, 2016), and the highest was 113.07% (Mato Grosso do Sul, 2015).

The SD measurements reveal the magnitude of the oscillation in the VC coefficients in the analyzed period. The states' vaccination coverage during the historical series (2013-2021) presented standard deviations between 7.04 (Federal District) and 18.45 (Roraima). The states with the highest fluctuations in VC coefficients were Roraima (SD = 18.45), Mato Grosso do Sul (SD = 18.36), and Rio de Janeiro (SD = 17.59), and the states with the lowest fluctuations were Distrito Federal (SD = 7.04), Tocantins (SD = 9.16) and Piauí (SD = 9.74). Concerning years, the highest disparities between states occurred in 2015 (SD = 10.9) and the smallest in 2013 (SD = 5.9).

Table I – Percentage of general vaccination coverage, average and standard deviation by year and Federation Unit, Brazil, 2013-2021.

UF ¹	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean (UF)	SD ² (UF)
North Region											
Acre	58.9	59.3	75.5	46.9	63.6	69.8	74.8	56.3	48.8	60.7	10.4
Amapá	67.7	76.1	88.8	56.6	57.9	63.8	69.3	44.1	44.2	63.1	14.5

Table I – Percentage of general vaccination coverage, average and standard deviation by year and Federation Unit, Brazil, 2013-2021. (continuation)

UF ¹	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean (UF)	SD ² (UF)
Amazonas	67.1	77.1	94.9	48.3	71.1	75.2	79.8	65.2	60.5	69.6	13.1
Pará	67.9	71.7	67.5	41.4	57.4	60.5	65.1	54.9	48.5	58.7	9.9
Roraima	60.7	82.3	105.3	57.4	89.2	83.5	77.5	63.9	45.9	72.2	18.5
Rondônia	76.7	98.2	111.3	63.8	85.1	82.9	82.1	74.8	63.1	81.1	15.4
Tocantins	72.8	85.1	92.4	60.9	77.9	81.1	82.1	77.3	69.6	76.9	9.2
Northeast Region											
Alagoas	67.3	84.1	92.7	44.9	74.7	81.2	71.8	59.9	60.1	69.2	14.6
Bahia	72.3	83.8	93.1	44.4	65.1	65.4	65.1	60.5	51.4	65.9	14.9
Ceará	73.1	96.6	107.7	56.4	84.5	88.4	75.2	71.5	59.7	77.7	16.7
Maranhão	73.5	83.3	94.4	43.4	64.4	68.1	63.2	50.8	50.5	64.9	16.4
Paraíba	71.4	83.5	86.3	50.1	70.1	74.5	76.9	61.2	56.6	69.2	12.1
Pernambuco	71.8	86.4	101.1	51.4	72.9	76.9	71.1	61.9	56.8	71.3	15.2
Piauí	71.9	76.1	80.7	46.9	68.4	72.9	69.6	64.3	62.2	67.0	9.7
Rio Grande do Norte	66.9	82.4	89.2	42.2	55.9	70.9	68.2	62.5	58.9	65.1	13.9
Sergipe	74.8	86.1	91.0	47.1	68.4	75.2	68.8	59.2	61.3	69.3	13.6
Midwest Region											
Distrito Federal	85.8	89.3	71.6	75.3	74.9	82.2	79.1	76.1	66.8	77.9	7.0
Goiás	79.4	86.6	93.6	53.6	72.2	76.8	71.9	70.2	61.4	72.9	12.1
Mato Grosso	75.0	92.6	100.3	58.3	76.6	80.8	78.3	74.4	65.2	76.8	12.7
Mato Grosso do Sul	81.8	110.1	113.1	63.6	85.8	94.4	90.8	73.1	61.5	85.0	18.4
Southeast Region											
Espírito Santo	72.3	90.9	98.4	51.2	73.3	80.9	75.3	74.8	68.3	74.7	13.5
Minas Gerais	80.0	90.2	100.3	57.6	76.3	84.7	77.9	77.7	67.6	78.1	12.3
Rio de Janeiro	68.1	84.1	96.1	47.9	77.3	72.7	61.2	47.8	46.2	65.8	17.6
São Paulo	73.4	88.2	98.6	45.9	73.0	78.8	74.5	70.9	62.2	72.3	14.9
South Region											
Paraná	77.6	86.9	96.4	55.3	79.8	82.4	82.9	77.7	69.6	77.5	11.4
Rio Grande do Sul	73.5	84.2	87.7	53.9	73.5	78.3	79.5	77.8	64.7	73.8	10.3
Santa Catarina	72.9	91.8	100.7	58.9	79.4	84.5	83.9	81.5	71.7	79.6	12.1
Average (year)	73.3	86.3	95.1	50.4	72.9	77.1	73.4	67.3	59.9	71.7	13.2
SD² (year)	5.9	9.2	10.9	7.9	8.6	7.7	7.0	10.1	7.9	6.5	-

Source: SI-PNI: National Immunization Program Information System; DATASUS: Information Technology Department of the Unified Health System; TABNET: Public Domain Generic Tabulator – MS, Brazil, 2022.

Legend: 1. Federation Unit; 2. Standard Deviation.

Figure 1 allows better visualization of the differences between states in VC coefficients, considering the averages between 2013-2021. Within the scope of this study, and considering the average for the period under analysis, the states can be classified as (a) high VC (above 76%) – Mato Grosso do Sul, Rondônia, Santa Catarina, Minas Gerais, Distrito Federal, Ceará, Paraná, Tocantins, and Mato Grosso; (b) intermediate VC (above 66% to 76%) – Espírito Santo, Rio Grande do Sul, Goiás, São Paulo, Roraima, Pernambuco, Amazonas, Sergipe, Paraíba, Alagoas, and Piauí; and (c) low VC (below 66%) – Bahia, Rio de Janeiro, Rio Grande do Norte, Maranhão, Amapá, Acre, and Pará.

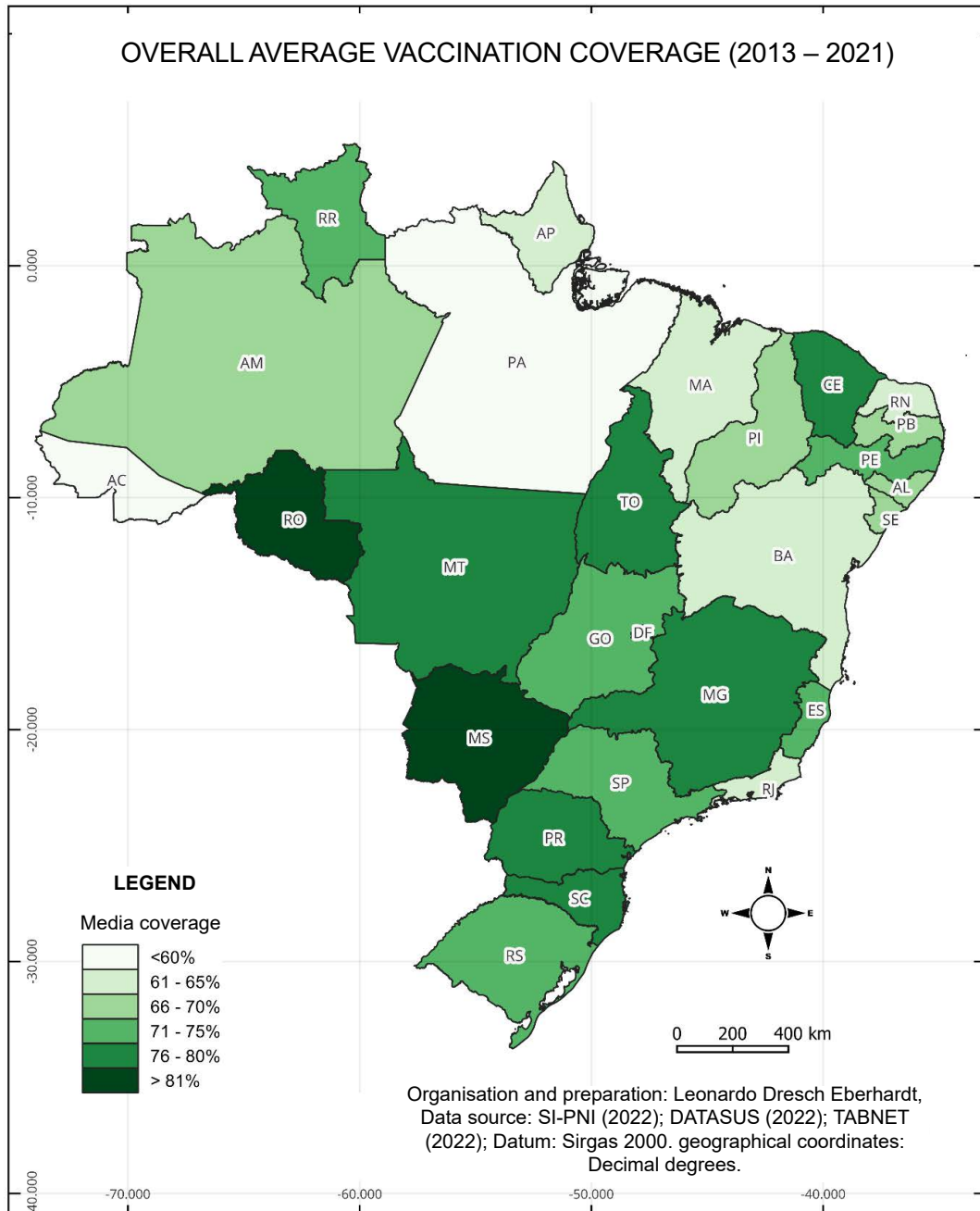


Figure 1 – Map of Brazil and Federation Units considering the general averages of vaccination coverage from 2013 to 2021.

Source: SI-PNI: National Immunization Program Information System; DATASUS: Information Technology Department of the Unified Health System; TABNET: Public Domain Generic Tabulator – MS, Brazil, 2022.

Grouping the data by region of the country makes it possible to interpret the VC “curve” behavior in Brazil from 2013 to 2021 (Figure 2). Initially, it seems that the variation in VC coefficients is quite similar between the country regions, maintaining a pattern: growth in vaccination coverage between 2013 (between 70 and 80%) and 2015 (around 90%), reaching peak; sharp drop between 2015-2016, reaching out the lowest level in the historical series, around 50%; slow growth between 2017-2018, reaching out, again the 2013 level (between 70 and 80%); maintenance in 2019; and drop in VC from 2020, reaching out, in 2021, levels between 50 and 70%, with higher inequalities between the regions of the country.

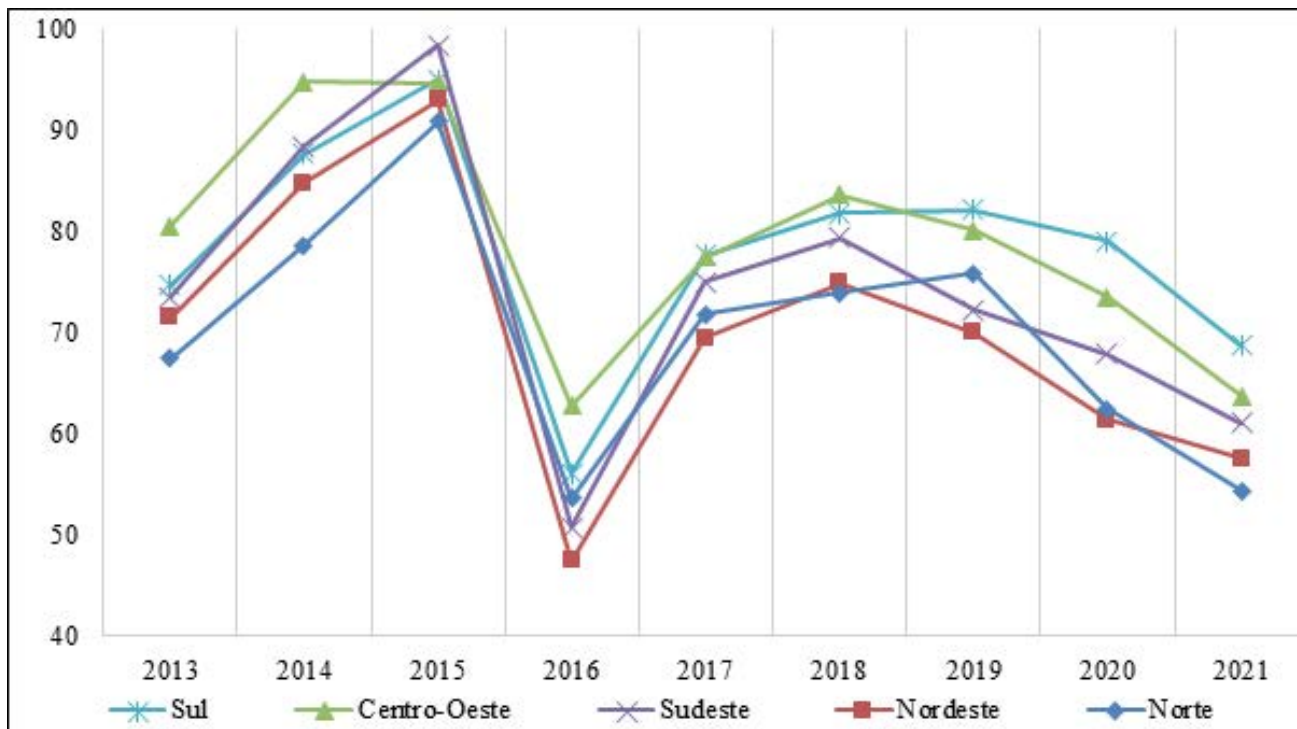


Figure 2 – Percentage of vaccination coverage by year and Regions, Brazil, 2013-2021.

Source: SI-PNI: National Immunization Program Information System; DATASUS: Information Technology Department of the Unified Health System; TABNET: Public Domain Generic Tabulator – MS, Brazil, 2022.

The country’s Regions also present a “pattern” regarding VC coefficients: in general, the South and Central-West Regions have higher vaccination coverage than the other Regions; the Southeast Region tends to have intermediate vaccination coverage; and the Northeast and North Regions have lower vaccination coverage.

To compare vaccination coverage in previous years (2018 and 2019) and during (2020-2021) the COVID-19 pandemic, calculations of averages, percentage differences, and percentage drops in VC were carried out, as shown in Table II.

Table II – Average vaccination coverage, percentage difference, and percentage drop in vaccination coverage by Federation Units, Brazil, 2018-2022.

Federation unity	2018-19 ¹ [%]	2020-21 ² [%]	Difference of % ³	% of Fall ⁴
North Region				
Acre	72.33	52.58	-19.76	-27.31
Amapá	66.52	44.12	-22.40	-33.67
Amazonas	77.51	62.88	-14.63	-18.06
Pará	62.81	51.68	-11.13	-17.72
Rondônia	82.52	68.91	-13.61	-16.49
Roraima	80.49	54.90	-25.60	-31.80
Tocantins	81.62	73.49	-8.14	-9.97

Table II – Average vaccination coverage, percentage difference, and percentage drop in vaccination coverage by Federation Units, Brazil, 2018-2022. (continuation)

Federation unity	2018-19 ¹ [%]	2020-21 ² [%]	Difference of % ³	% of Fall ⁴
Northeast Region				
Alagoas	76.49	59.99	-16.5	-21.57
Bahia	65.25	55.96	-9.30	-14.25
Ceará	81.81	65.63	-16.18	-19.77
Maranhão	65.67	50.66	-15.02	-22.87
Paraíba	75.71	58.87	-16.84	-22.24
Pernambuco	74.03	59.36	-14.67	-19.81
Piauí	71.22	63.23	-7.99	-11.21
Rio Grande do Norte	69.55	60.69	-8.86	-12.73
Sergipe	72.03	60.23	-11.80	-16.38
Midwest Region				
Distrito Federal	80.67	71.42	-9.25	-11.46
Goiás	74.36	65.78	-8.58	-11.53
Mato Grosso	79.53	69.84	-9.69	-12.18
Mato Grosso do Sul	92.62	67.29	-25.33	-27.34
Southeast Region				
Espírito Santo	78.15	71.56	-6.59	-8.43
Minas Gerais	81.30	72.65	-8.64	-10.62
Rio de Janeiro	66.93	47.01	-19.93	-29.77
São Paulo	76.65	66.54	-10.11	-13.18
South Region				
Paraná	82.64	73.63	-9.01	-10.90
Santa Catarina	84.22	76.60	-7.62	-9.04
Rio Grande do Sul	78.86	71.23	-7.63	-9.67
BRAZIL	75.29	63.56	-11.73	-15.57

Source: SI-PNI: National Immunization Program Information System; DATASUS: Information Technology Department of the Unified Health System; TABNET: Public Domain Generic Tabulator – MS, Brazil, 2022.

Caption: 1. Average vaccination coverage in 2018 and 2019, before the new coronavirus pandemic; 2. Average vaccination coverage in 2020 and 2021, during the pandemic; 3. Subtraction of the average vaccination coverage for 2018-2019 concerning the average vaccination coverage for 2020-2021, demonstrating how many percentage points vaccination coverage varied in the period; 4. Divide the "percentage difference" by the average vaccination coverage in 2018-2019, multiplied by 100, demonstrating the percentage drop in vaccination coverage in the two periods.

Table II allows us to state that all states in Brazil, without exception, showed a drop in VC during the pandemic period (2020-2021) compared to the previous period (2018-2019). The state of Amapá presented the highest percentage of decline in VC (33.67%), that is, almost a third, while the state of Espírito Santo presented the lowest percentage of decline (8.43%).

The states can be grouped according to the intensity of the drop in vaccination coverage during the pandemic: (a) states with relatively high drops in VC (percentage of drop above 26%) – Amapá, Roraima, Rio de Janeiro, Mato Grosso do Sul and Acre; (b) states with intermediate drops in VC (percentage of drop between 16% and 26%) – Maranhão, Paraíba, Alagoas, Pernambuco, Ceará, Amazonas, Pará, Rondônia, and Sergipe; (c) states with relatively low drops in VC (percentage of drop below 16%) – Bahia, São Paulo, Rio Grande do Norte, Mato Grosso, Goiás, Distrito Federal, Piauí, Paraná, Minas Gerais, Tocantins, Rio Grande do South, Santa Catarina and Espírito Santo.

Finally, the situation of Brazilian states regarding VC can be analyzed between 2013 and 2021 by crossing data about the general average and the percentage of decline during the COVID-19 pandemic, as shown in Frame 1, grouping them into six quadrants.

Frame 1 – Situation of Brazilian states regarding average vaccination coverage in the period from 2013 to 2021 and the percentage of decline in vaccination coverage during the pandemic (2020-2021).

	High drop ²	Intermediate drop ²	Low drop ²
High average ¹	Mato Grosso do Sul	Ceará Rondônia	Santa Catarina Tocantins Distrito Federal Minas Gerais Paraná Mato Grosso
Intermediate average ¹	Roraima	Pernambuco Amazonas Paraíba Alagoas Sergipe	Rio Grande do Sul São Paulo Goiás Espírito Santo Piauí
Low average ¹	Amapá Rio de Janeiro Acre	Pará Maranhão	Bahia Rio Grande do Norte

Source: own elaboration based on data from Source: SI-PNI: Information System of the National Immunization Program; DATASUS: Information Technology Department of the Unified Health System; TABNET: Public Domain Generic Tabulator – MS, Brazil, 2022. Caption: 1. Average vaccination coverage in the period 2013-2021; 2. Percentage of drop in vaccination coverage during the pandemic period (2020-2021 average) compared to the period before the pandemic (2018-2019 average).

Considering the period 2013-2021, including the drop percentages during the COVID-19 pandemic, on the one hand, the states that were in a better relative vaccination situation are presented in the upper right quadrant (Frame 1), with relatively high averages of VC and with relatively low percentages of decline – Santa Catarina, Tocantins, Distrito Federal, Minas Gerais, Paraná, and Mato Grosso. On the other hand, the states that were in the worst relative vaccination situation are presented in the lower left quadrant (Frame 1), with relatively low averages and relatively high drop percentages – Amapá, Rio de Janeiro and Acre.

DISCUSSION

The drops in VC in Brazil, which were already worrying before the COVID-19 pandemic, became even more pronounced⁽⁷⁾, demonstrating possible weaknesses in the management and execution of the National Immunization Policy^(15,16). Discussing the factors that are intertwined with this problem requires an analysis of the political and economic context experienced and current operational issues in the SUS service network.

The pandemic heightened the population’s feeling of insecurity and strengthened the anti-vaccine movement and vaccine hesitancy, including the dissemination of false information about the lack of effectiveness of vaccines and non-existent adverse events⁽¹⁷⁾. Vaccine hesitancy or resistance to vaccination is already recognized as one of the main concerns in the management of immunization policy, and it is among the ten threats to global health recognized as a growing global issue⁽¹⁸⁾. Hesitants are individuals who do not entirely reject vaccines but fluctuate by not accepting the full recommended vaccination schedule, refusing only some vaccines, or even delaying the vaccination schedule due to doubts about the benefits and risks of the vaccine⁽¹⁹⁾.

The COVID-19 pandemic has impacted several health services, compromising some health indicators, such as indicators related to Chronic Non-Communicable Diseases (NCDs)⁽²⁰⁾. Among other activities, disease tracking and diagnosis were suspended, treatments were interrupted, and consultations and surgeries were canceled. This scenario, associated with the direct impact of COVID-19 on the population, resulted in a decrease in life expectancy in Brazil in 2020, in the order of 1.3 years at birth and 0.9 years at 65 years of age⁽²¹⁾.

The financing crisis and the scrapping of SUS services also play a determining role in access to vaccination. The scarcity of resources and management difficulties may be directly related to drops in coverage. Constitutional Amendment 95, approved in 2016⁽²²⁾, imposed a freeze on public spending for 20 years and transferred even more responsibilities to municipalities, which may have contributed to the sharp drop in state coverage. In 2016, all Federation Units showed sudden reductions in their vaccination coverage. As of 2016, policies in defense of

health as a universal right and duty of the State have not been accepted by the Federal Executive and Legislative branches, and several political decisions have compromised and institutionally weakened the technical basis of the SUS, already financially affected by the implementation of Constitutional Amendment 95⁽²³⁾.

The scientific literature recognizes that the drop in vaccination coverage is not the result of a single factor but a set of situations in which the pandemic is added as an aggravating factor^(24,25). Immunization is a prevention practice that suffered from the restriction of health services imposed during the pandemic to mitigate it. Many vaccination rooms were compulsorily closed due to the lack of professionals on leave due to the disease or the risk of contamination, making it even more difficult for the population to access this policy, combined with the population's fear of seeking health services other than in an emergency due to the risk of contagion.

Although the COVID-19 pandemic meant a drop in the vaccination coverage across the country, the research results demonstrate that this drop was not uniform: the states showed different intensities of percentage drops in VC. In this sense, the new coronavirus pandemic tends to reproduce regional inequalities in terms of public health and, more specifically, concerning immunization in Brazilian territory.

The inequalities presented by Brazilian states concerning vaccination coverage between 2013 and 2021, and especially during the COVID-19 pandemic, may reflect inequalities within the scope of the structuring of health policies (primary care, immunization, child health, etc.) and social policies in general (employment, transport, education, etc.), in terms of financing, management, and execution. It is possible to assume that states with lower fluctuations in vaccination coverage between 2013 and 2021 (such as the Federal District and Tocantins) have higher continuity in their immunization policy.

Such inequalities can be discussed based on the concept of health inequities, that is, the disparities created by historical processes and modes of organization and social production that impact the population's levels of health and access, constituting a challenge for health promotion policy^(9,10). In this context, both the health-disease process and health interventions must be understood more broadly, produced, and determined socially and historically by the forms of organization of society⁽²⁶⁾.

It should be noted that data on overestimated VC (above 100%) can be explained by discrepancies in the estimated number of live births used for the calculation, errors in recording doses applied, or even migration and population movement for reasons specific to the territory. This is the case in several Brazilian states in 2015 – Rondônia, Roraima, Ceará, Pernambuco, Minas Gerais, Santa Catarina, Mato Grosso, and Mato Grosso do Sul. In this sense, it is necessary to improve information systems, facing technical challenges and existing operations⁽²⁷⁾.

Considering that the VC indicator is a relevant management instrument and guides decision-making, it is necessary to reflect on the sharp reduction of this indicator after the COVID-19 pandemic and restructure the Immunization Policy with adjustments at the three government levels⁽²⁸⁾. Otherwise, the scenario points to the re-emergence of vaccine-preventable diseases such as measles, diphtheria, whooping cough, and polio^(25,29,30).

Finally, the need to expand and improve the health promotion policy is highlighted by strengthening health education actions, with access to safe, understandable, and reliable information⁽³¹⁾. Improving immunization policy and promoting increased vaccination coverage require new ways of producing and disseminating information in the media and social networks on the importance of vaccination. Health is a fundamental right, and access to vaccination must be universal and the responsibility of the State, which must encourage and promote strategies to clarify and empower the population about the importance of vaccines⁽¹⁸⁾.

CONCLUSION

The COVID-19 pandemic negatively impacts Brazilian states VC coefficients, which had already shown drops in the previous period. During the historical series analyzed, it was possible to identify regional inequalities related to vaccination coverage in Brazilian states. Inequalities reproduced during the COVID-19 pandemic and that constitute health inequities.

Among the limitations of the present study, it is possible to highlight the ecological nature of the approach and the non-use of inferential statistics for data analysis. Despite these limitations, the study results show contributions to understanding the immunization scenario in the country and reflections on Health Surveillance in the current context.

The need to develop studies to monitor the behavior of vaccination coverage in subsequent years is highlighted, as well as field research that analyzes local situations (municipalities, health units, and vaccination rooms) and that evaluates the impact of drops in VC on re-emergence of vaccine-preventable diseases.

The necessary revitalization of the PNI and increasing vaccination coverage in the national territory requires joint efforts from governments, health workers, researchers, and educational and social control entities. Such revitalization must include education and information dissemination actions, as well as financing and management process improvement.

INTEREST CONFLICTS

The authors declare that there is no conflict of interest.

CONTRIBUTIONS

The authors contributed equally to the preparation of the study; in the search, analysis, and interpretation of data; and in writing and reviewing the manuscript. The authors have approved the final version of the manuscript to be published and are responsible for all aspects of it, including ensuring its accuracy and integrity.

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