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Research Article

Coverage of pneumococcal, polio and rotavirus vaccines in Brazil: descriptive study, 2017 to 2020

Cobertura das vacinas pneumocócica, contra poliomielite e rotavírus no Brasil: estudo descritivo, 2017 a 2020

Cobertura de las vacunas antineumocócica, antipoliomielítica y rotavirus en Brasil: estudio descriptivo, 2017 a 2020

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Abstract

Introduction: Recent years have been marked by a drop in vaccine coverage, creating a risk of outbreaks and epidemics of vaccine-preventable diseases. **Objective:** To describe the coverage of pneumococcal, polio and rotavirus vaccines from 2017 to 2020, in the regions and federative units (FUs). **Methods:** Descriptive study, with data from the Information System of the National Immunization Program. The vaccination coverage of each immunobiological agent was obtained according to the twenty-seven FUs, regions and whole Brazil, and the absolute differences in the coverage of each vaccine, from 2019 compared to 2020, were calculated. **Results:** In 2017 and 2020, respective coverage rates for pneumococcal vaccine were 92.2 and 81.0%, for polio vaccine 84.7 and 75.8% and for rotavirus vaccine 85.1 and 77.0%. The coverage of immunologicals showed an absolute difference of approximately 8 percentage points in the period between 2019 and 2020. No FU achieved adequate coverage for poliomyelitis and rotavirus. **Conclusion:** There was a drop in vaccination coverage between 2019 and 2020, with lower coverage for poliomyelitis, followed by rotavirus and pneumococcal disease, which may be related to the COVID-19 pandemic.

Keywords: Immunization programs; Child health; Pneumococcal vaccines; Poliovirus vaccines; Rotavirus vaccines.

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Resumo

Introdução: Os últimos anos têm sido marcados por queda nas coberturas vacinais, gerando risco para surtos e epidemias de doenças imunopreveníveis. **Objetivo:** Descrever a cobertura das vacinas pneumocócica, contra poliomielite e rotavírus, de 2017 a 2020, nas regiões e unidades da federação (UFs) do Brasil. **Métodos:** Estudo descritivo com dados do Sistema de Informação do Programa Nacional de Imunizações (SI-PNI). Obtiveram-se as coberturas vacinais para cada imunobiológico nas 27 UFs, bem como para as diferentes regiões e para o Brasil no período de 2017 a 2020. Além disso, calcularam-se as diferenças absolutas das coberturas de cada vacina entre os anos de 2019 e 2020. **Resultados:** Em 2017 e 2020, a vacina pneumocócica registrou índices de 92,2 e 81,0%, respectivamente, enquanto a contra poliomielite teve cobertura de 84,7 e 75,8%, e a contra rotavírus apresentou cobertura de 85,1 e 77,0%. A diferença absoluta das coberturas dos imunobiológicos foi de aproximadamente 8 pontos percentuais entre 2019 e 2020. Nenhuma UF atingiu cobertura adequada para poliomielite e rotavírus. **Conclusão:** Houve redução na cobertura vacinal durante o período entre 2019 e 2020, com as coberturas mais afetadas sendo as da vacina contra poliomielite, seguida pela vacina contra rotavírus e, por fim, da vacina pneumocócica. Essa diminuição pode estar relacionada à pandemia da doença do novo coronavírus (COVID-19).

Palavras-chave: Programas de imunização; Saúde da criança; Vacinas pneumocócicas; Vacinas contra poliovírus; Vacinas contra rotavírus.

Resumen

Introducción: Los últimos años se han caracterizado por una caída en la cobertura de vacunas, creando un riesgo de brotes y epidemias de enfermedades prevenibles por vacunación. **Objetivo:** Describir la cobertura de las vacunas antineumocócica, antipoliomielítica y rotavirus, de 2017 a 2020, en las regiones y unidades de la federación (UFs). **Métodos:** Estudio descriptivo, con datos del Sistema de Información del Programa Nacional de Inmunizaciones. Se obtuvo la cobertura de vacunación de cada agente inmunobiológico según las veintisiete UF, regiones y Brasil, y se calcularon las diferencias absolutas en la cobertura de cada vacuna, de 2019 con respecto a 2020. **Resultados:** En 2017 y 2020, la enfermedad neumocócica aumentó del 92,2 al 81,0%, poliomielitis del 84,7 al 75,8%, rotavirus del 85,1 al 77,0%. La cobertura de inmunológicos mostró una diferencia absoluta de aproximadamente 8 puntos porcentuales en el período comprendido entre 2019 y 2020. Ninguna UF logró una cobertura adecuada para poliomielitis y rotavirus. **Conclusión:** hubo una caída en la cobertura de vacunación entre 2019 y 2020, con menor cobertura de poliomielitis, seguida de rotavirus y enfermedad neumocócica, que pueden estar relacionados con la pandemia COVID-19.

Palabras clave: Programas de inmunización; Salud del niño; Vacunas neumocóocicas; Vacunas contra poliovirus; Vacunas contra rotavirus.

INTRODUCTION

The drop in vaccination coverage in Brazil in recent years has been cause for concern among health authorities, due to the occurrence of epidemics, such as measles, in 2017,[1] and successive yellow fever epidemics between 2016 and 2019.[1] In addition, there is the risk of resurgence of other diseases, such as polio, possibly as a result of reduced vaccination adherence.[2]

The reduction in vaccination coverage in Brazil affects all immunizations, including those administered in the first months of life (at two, four and six months of age), such as pneumococcal, polio and rotavirus vaccines. These vaccines are offered mainly in primary health care (PHC). Their coverage respectively from 88.4, 96 and 86.4% in 2012 to 84.5, 79.3 and 80.1% in 2018.[3] Furthermore, there is great heterogeneity in vaccination coverage in the country, with no single direction in the relationship between vaccination coverage and socioeconomic stratum or region of the country.[3-5]

Different factors have been associated with the decrease in vaccination coverage, such as the anti-vaccine movement, the public's reduced perception of the risks of diseases, fear of side effects of vaccines, lack of confidence in their effectiveness, the unavailability of immunization agents and the preference for other forms of protection. [3,6] With the declaration of the COVID-19 pandemic by the WHO in March 2020, there was a significant reduction in the use of health services around the world, including childhood vaccination. This was because of the isolation and social distancing measures implemented to control and reduce the transmission of the disease.[7-11]

The World Health Organization (WHO) estimates that the drop in vaccination coverage during the COVID-19 pandemic will leave around 117 million children susceptible to vaccine-preventable diseases worldwide.[12]

Considering the need to monitor vaccination coverage, quantify differences and measure a possible reduction in vaccination coverage in Brazil due to the COVID-19 pandemic, this study aimed to assess the coverage of pneumococcal, polio and rotavirus vaccines in the period of 2017 to 2020, in the different regions and federative units.

METHODS

Descriptive study of pneumococcal, polio and rotavirus vaccination coverage from 2017 to 2020, using as a secondary database the National Immunization Program Information System (SI-PNI) of the Ministry of Health (MS) database. These years were chosen with the intention of covering both the period before and during the COVID-19 pandemic.

Children who received the second dose of pneumococcal vaccine 10, the third dose of the polio vaccine and the second dose of the rotavirus vaccine were analyzed in Brazil, in the twenty-seven FUs and in the regions (North, Northeast, Central-West, Southeast and South). The formula used to calculate coverage was the number of final doses of the vaccination schedule applied divided by the target population, multiplied by 100.

In this study, the coverage of pneumococcal, polio and rotavirus vaccines was considered, which were selected because they did not show distribution problems, as with the pentavalent vaccine in 2019. Furthermore, these vaccines showed uniformity in relation to distribution and immunological characteristics on the calendar during the period evaluated. The doses chosen represent the complete regimen up to one year of age, as listed below:

- Second dose of pneumococcal vaccine 10: administered at four months of age;
- Third dose of polio vaccine (IPV): administered at six months of age;
- Second dose of rotavirus vaccine (ROTA): administered at four months of age.

The coverage target recommended by the SI-PNI for pneumococcal and polio vaccines is 95%, while for the rotavirus vaccine it is 90%.

Coverage data were directly extracted from the SI-PNI. More information about calculating coverage can be accessed through the link https://www.gov.br/saude/pt-br/media/pdf/2021/setembro/16/informe-multivacinacao_cgpni_atualizacao-tecnica_14_setembro-2021_fernanda-1 .pdf. For the period studied (2017 to 2020), the vaccination coverage of each immunobiological product was obtained, considering FUs, regions and Brazil.

Coverage was calculated for each year, with the absolute number of doses applied of each immunobiological as the numerator and the population under one year old obtained by the Live Birth Information System (SINASC) as the denominator.

A descriptive analysis of vaccination coverage was carried out from 2017 to 2020. Specifically for the years 2019 and 2020, because of the health situation resulting from the COVID-19 pandemic, it was decided to present the absolute differences in percentage points (p.p.) for the coverage of each vaccine, comparing the years 2019 and 2020, in the FUs, regions and across the country. Furthermore, the coverage of FUs for the years 2019 and 2020 were categorized into three groups: 0 to 59.9%; 60.0 to

89.9%; and 90.0 to 100%. These categories were defined in accordance with the vaccination coverage targets established by the World Health Organization in the global vaccine action plan.[13]

The data were stored in .csv files using the Microsoft Office Excel® 2010 program. These data were then tabulated and analyzed.

The analysis was conducted solely with aggregated data from publicly accessible secondary sources. As it did not involve a study with human beings, there was no need for review by the Research Ethics Committee.

RESULTS

When evaluating vaccination coverage between 2017 and 2020 in Brazil and its regions, a similar pattern was observed for the three immunobiologicals. Coverage increased or remained constant between 2017 and 2019, but there was a more evident reduction in 2020, resulting in the lowest vaccination coverage between the years investigated. The coverage of the pneumococcal vaccine decreased from 92.2% in 2017 to 81.0% in 2020, while the polio vaccine had coverage of 84.7% in 2017 and 75.8% in 2020. Rotavirus vaccine coverage went from 85.1% in 2017 to 77.0% in 2020. When comparing regions, there was lower coverage in the North region over the period from 2017 to 2020 (Figure 1) .

The results highlighted a reduction in vaccine coverage analyzed in 2020 compared to 2019, both nationally and in regions and FUs. In Brazil, coverage of pneumococcal, polio and rotavirus vaccines showed an absolute difference of around 8 p.p. between 2019 and 2020. In relation to regions, the largest absolute variations between the years studied were observed in the North and Northeast (greater than 10 p.p.). When analyzing the FUs, the states of Acre, Amapá, Alagoas, Maranhão, Paraíba and Rio de Janeiro showed absolute differences of at least 15 p.p. in the coverage of the three vaccines (Table 1).

Figures 2, 3 and 4 present the coverage rates of pneumococcal, polio and rotavirus vaccines in 2019 and 2020, categorized into three ranges: 0-59.9%; 60.0-89.9%; and 90.0-100%. With regard to the pneumococcal vaccine, in 2019, 15 FUs had coverage over 90.0%, decreasing to just two in 2020 (Ceará and Santa Catarina). In 2019, five states had coverage over 90.0% for polio, while six had coverage over 90.0% for the rotavirus vaccine. However, in 2020, no state achieved coverage over 90.0% for polio and rotavirus vaccine.

DISCUSSION

The results of this study indicate a decrease in p.p. in vaccination coverage in the period from 2017 to 2020, with a more significant drop in coverage during 2020, coinciding with the beginning of the COVID-19 pandemic. This reduction was most evident for polio vaccine, followed by rotavirus vaccine and pneumococcal vaccine. It is important to highlight the lower coverage in the North and Northeast regions for the three immunizers.

It is worth recalling that this study was based on secondary data and may present some inaccuracies in the results due to possible errors in SI-PNI records. However, considering the analysis that compared coverage data from different years of the Department of Informatics of the Unified Health System (DATASUS), it is believed that this potential limitation does not compromise the purpose of the study, which identified an apparent negative impact of the pandemic on vaccination coverage against polio, pneumococcal and rotavirus, emphasizing regional disparities and between FUs.

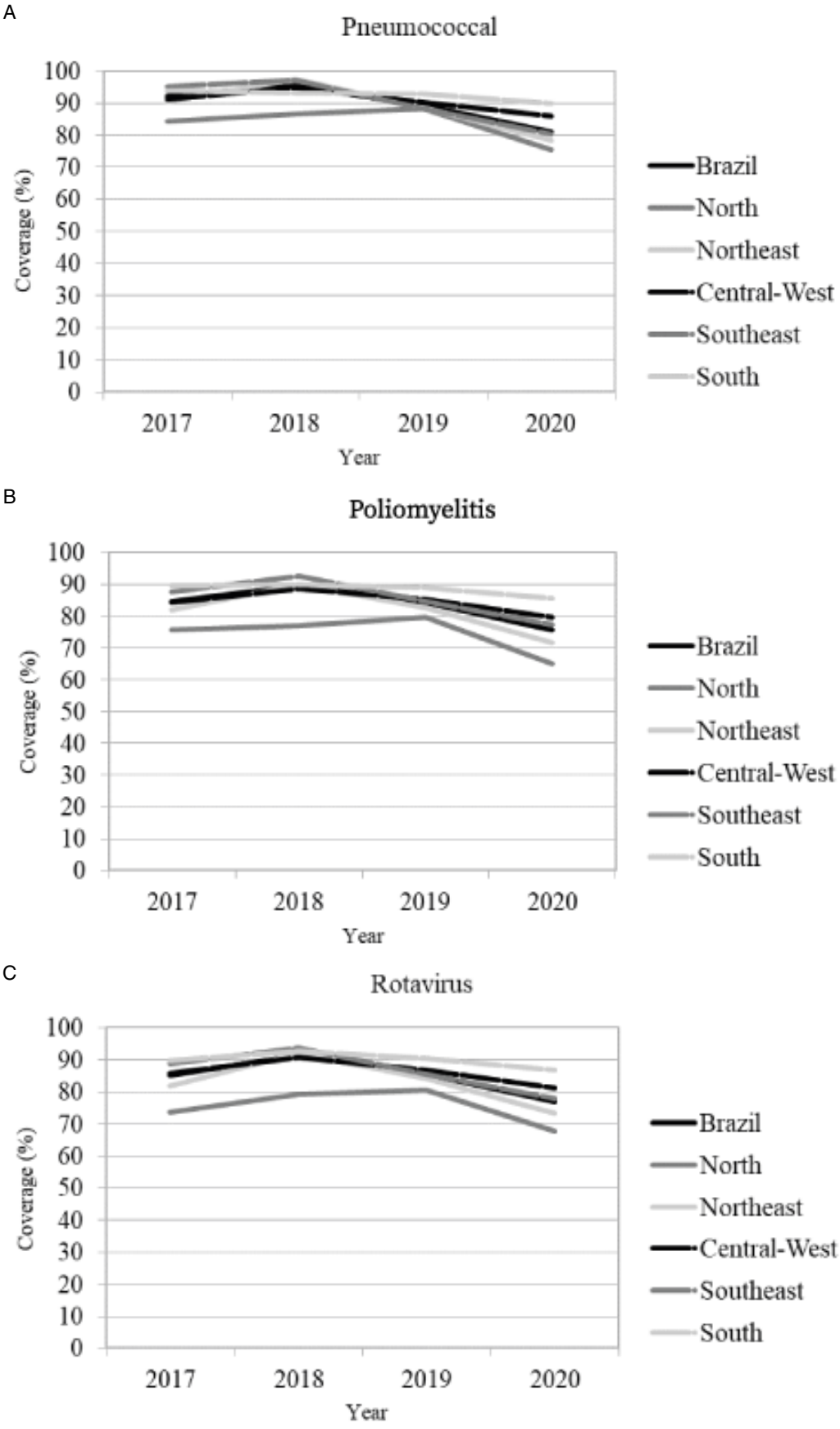

Figure 1. Coverage of pneumococcal (a), polio (b) and rotavirus (c) vaccines in Brazil, regions and federative units, 2017–2020.

Table 1. Coverage and absolute difference in percentage points of pneumococcal, polio and rotavirus vaccines in Brazil, regions and federative units, 2019–2020.

Location	Pneumococcal			Poliomyelitis			Rotavirus		
	2019	2020	Diff. p.p.*	2019	2020	Diff. p.p.*	2019	2020	Diff. p.p.*
North	**88.4**	**75.3**	**13.1**	**79.6**	**64.9**	**14.7**	**80.5**	**67.7**	**12.8**
Acre	91.5	73.0	18.5	81.7	62.6	19.1	84.5	65.6	18.9
Amapá	84.9	49.0	35.9	73.0	41.8	31.2	78.7	46.8	31.9
Amazonas	92.5	81.9	10.6	83.3	67.0	16.3	82.6	70.3	12.3
Pará	82.1	68.7	13.4	72.7	59.1	13.6	76.0	62.4	13.6
Rondônia	102.4	89.2	13.2	98.3	81.9	16.4	88.9	82.9	6.0
Roraima	90.3	86.4	3.9	79.8	72.8	7.0	78.9	74.7	4.2
Tocantins	94.0	88.8	5.2	88.2	83.8	4.4	88.7	83.5	5.2
Northeast	**88.5**	**78.3**	**10.2**	**82.7**	**71.8**	**10.9**	**84.0**	**73.3**	**10.7**
Alagoas	94.7	78.5	16.2	87.9	72.0	15.9	88.8	73.8	15.0
Bahia	79.6	76.2	3.4	74.8	69.6	5.2	75.2	71.0	4.2
Ceará	98.8	93.5	5.3	93.5	86.8	6.7	95.0	88.8	6.2
Maranhão	84.1	67.3	16.8	75.7	60.1	15.6	77.5	61.3	16.2
Paraíba	99.9	80.1	19.8	92.6	72.5	20.1	95.5	75.2	20.3
Pernambuco	90.1	76.9	13.2	85.6	71.5	14.1	86.7	72.4	14.3
Piauí	86.7	77.9	8.8	81.8	71.4	10.4	82.4	72.4	10.0
Rio Grande do Norte	89.3	77.2	12.1	80.7	69.6	11.1	84.6	73.2	11.4
Sergipe	84.7	73.5	11.2	80.9	70.6	10.3	82.0	70.8	11.2
Central-West	**90.1**	**85.9**	**4.2**	**85.4**	**79.8**	**5.6**	**86.7**	**81.1**	**5.6**
Distrito Federal	88.1	85.3	2.8	84.3	81.2	3.1	85.4	81.3	4.1
Goiás	87.0	84.2	2.8	81.5	77.7	3.8	84.0	80.1	3.9
Mato Grosso	90.6	88.6	2.0	85.8	80.8	5.0	86.2	81.3	4.9
Mato Grosso do Sul	98.2	86.5	11.7	94.4	81.7	12.7	94.8	82.9	11.9
Southeast	**88.2**	**80.4**	**7.8**	**84.5**	**77.4**	**7.1**	**85.6**	**77.9**	**7.7**
Espírito Santo	91.8	86.2	5.6	86.7	81.5	5.2	88.7	81.7	7.0
Minas Gerais	91.9	88.7	3.2	88.5	85.8	2.7	90.4	87.4	3.0
Rio de Janeiro	78.4	59.5	18.9	73.6	54.8	18.8	75.0	56.3	18.7
São Paulo	89.8	84.0	5.8	86.6	81.7	4.9	87.2	81.3	5.9
South	**92.8**	**90.0**	**2.8**	**89.0**	**85.8**	**3.2**	**90.6**	**86.8**	**3.8**
Paraná	92.4	89.5	2.9	89.7	85.8	3.9	90.8	87.0	3.8
Rio Grande do Sul	89.6	88.1	1.5	85.1	84.1	1.0	86.9	84.2	2.7
Santa Catarina	97.9	93.7	4.2	93.7	88.2	5.5	95.3	90.2	5.1
Brazil	**89.1**	**81.0**	**8.1**	**84.2**	**75.8**	**8.4**	**85.4**	**77.0**	**8.4**

*p.p.: percentage points, absolute difference.

Being a pioneering study with recent data covering the period of the pandemic, the descriptive analysis carried out can generate hypotheses about the impact of the crisis on the use of health services and guide future investigations with more detailed statistical analyses on the topic.

The drop in vaccination coverage since 2015 is a phenomenon observed globally and has gained a more worrisome scenario in the face of the COVID-19 pandemic.[7,8,14,15] A survey addressing

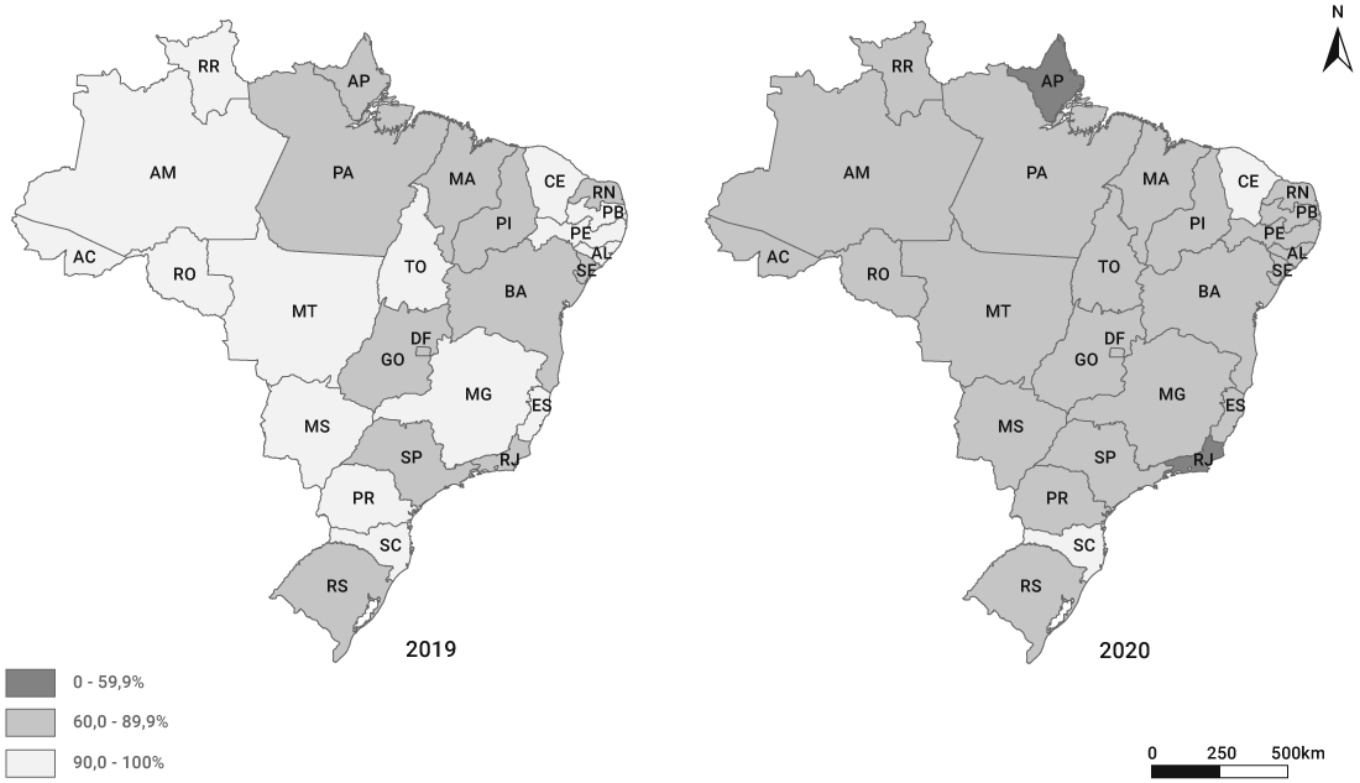

Figure 2. Coverage of pneumococcal vaccine by federative unit, Brazil, 2019–2020.

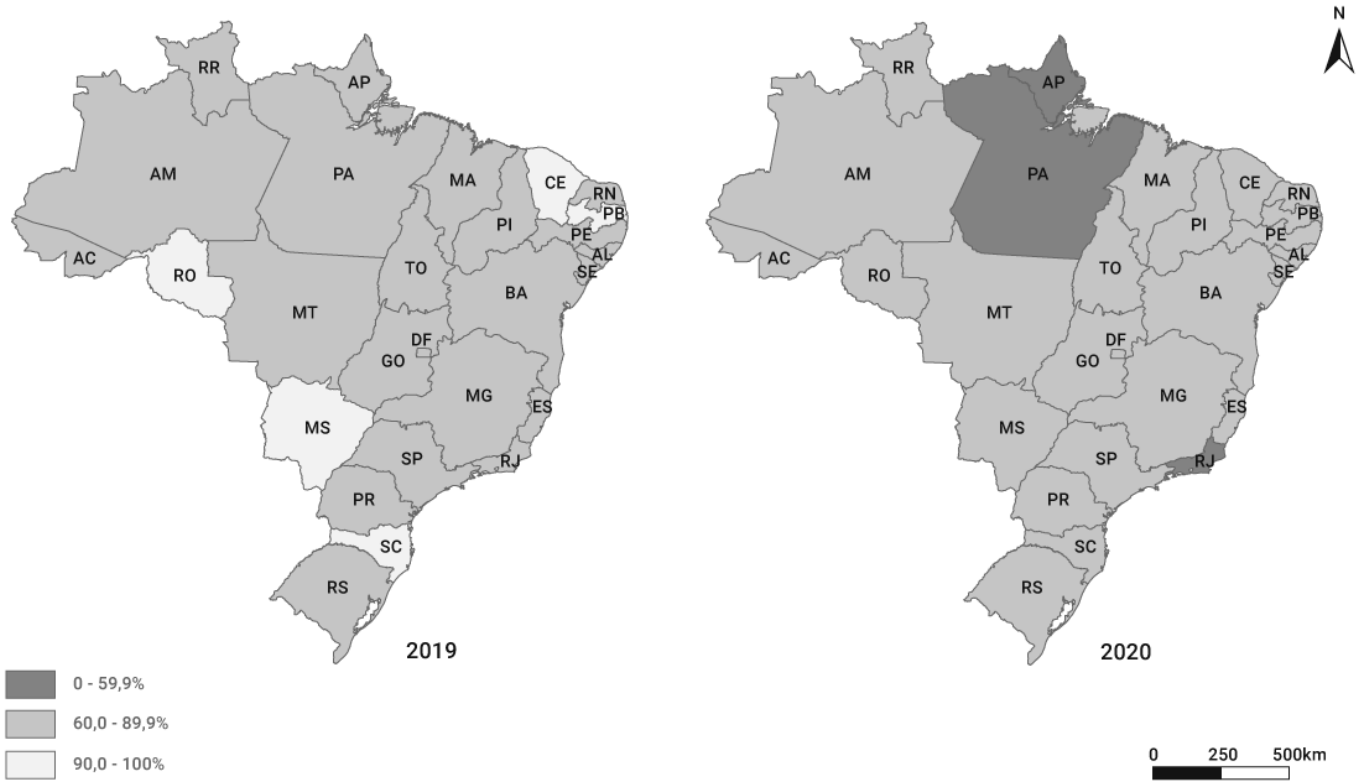

Figure 3. Coverage of polio vaccine per federative unit, Brazil, 2019–2020.

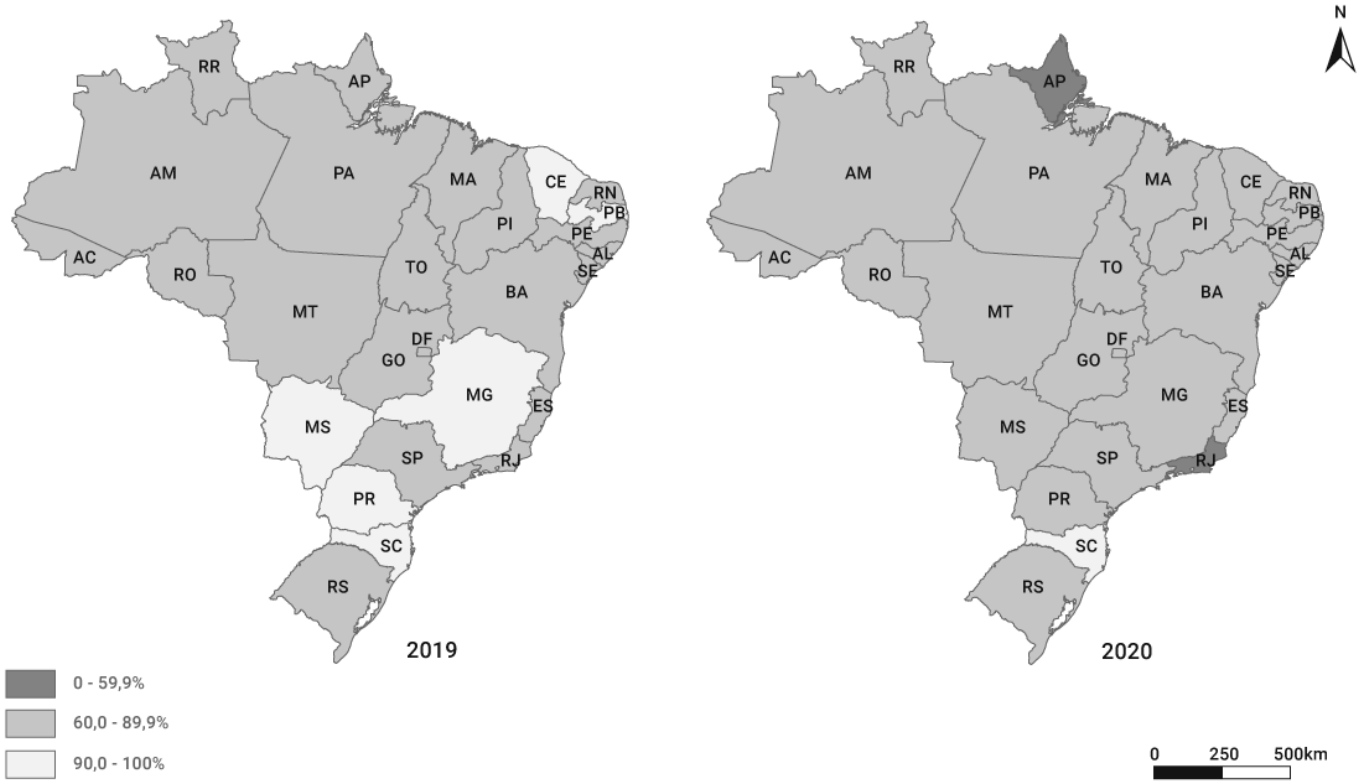

Figure 4. Coverage of rotavirus vaccine by federative unit, Brazil, 2019–2020.

global trends in vaccination coverage based on data from the Global Burden of Diseases, Injuries and Risk Factors Study (GBD) 2020 revealed that over the past decade (2009–2019), there has been a stabilization and even a decrease in childhood vaccination coverage rates. This decline became even more evident in countries in Latin America and the Caribbean, where vaccination coverage showed lower values.[16] In line with this, a study in Brazil identified a reduction in vaccination coverage in children in all regions of the country in the period from 2017 to 2019.[17] Additionally, supporting the results found in the period analyzed, information from the WHO and a study conducted in Brazil support the accentuated decrease in childhood vaccination coverage during the pandemic. A 20.0% drop in vaccination coverage was found in Brazil, resulting in the absence of vaccination for more than 23 million children worldwide.[12,18,19]

Some aspects of the pandemic are being associated with a decrease in vaccination coverage in 2020. This includes movement restriction measures, fear of exposure to COVID-19, people's reluctance to seek health services, difficulty in accessing services due to interruptions in public transport, time restrictions and fewer professionals available in health services. Additionally, many health units were reorganized to prioritize specific care for COVID-19.[19,20]

However, research conducted on the African Continent revealed that the risk of death from vaccine-preventable diseases is higher than the risk of death from COVID-19 in children. This reinforces the urgency of implementing measures to ensure the immunization of this population.[7] This study evaluated the coverage of three vaccines whose administration is planned for the first six months of newborns' lives, forming part of the initial vaccinations in the childhood calendar.[21] It is believed that the reduction in the specific coverage of these immunizers, besides making the newborn

more susceptible to infections, can reduce the probability of continuing the vaccination schedule and adherence to other immunological agents scheduled in the first year of life, as well as boosters, which has proven to lead to lower coverage.[3]

The results of this study show a decrease in vaccination coverage, with a more pronounced decline in lower-income states, with less developed health services and more vulnerable populations. These findings highlight the regional disparities and persistent inequalities already observed in other studies.[2,3] Similarly, international studies corroborate the presence of regional disparities in other countries, as well as the influence of social determinants in reducing vaccination coverage in children. Factors such as lower levels of education and income are associated with lower vaccination coverage, indicating that these elements must be taken into account by immunization programs to ensure an equitable distribution of vaccines.[22,23] In the same sense, research carried out in Brazil in 2020 also identified worse vaccination coverage in children from the North of the country, reinforcing persistent regional disparities.[18]

The Global Vaccine Action Plan 2011–2020 (GVAP), which was proposed during the World Health Assembly in 2012, urges all countries to achieve the target of ≥90% national coverage with all vaccines in the national immunization schedule until 2020.[13] However, the results of this study show that achieving this objective still represents a challenge to be overcome by the Unified Health System (SUS). The relevance of this goal is related to the magnitude of these diseases.

Poliomyelitis is a highly disabling disease and has not yet been eradicated in the world, which reinforces the need for large-scale vaccination.[24] Likewise, pneumococcal diseases are a significant cause of morbidity and mortality in the first year of life. Vaccination against these diseases has proven effectiveness, reducing approximately 30% of hospitalizations and 20% of deaths due to pneumonia in this age group.[25] Immunization against rotavirus also has a proven effect in reducing the use of health services, reducing hospitalizations due to diarrhea in around 30% among children.[26] Ensuring high vaccination coverage also contributes to reducing the use of PHC services and reducing complications that result in avoidable hospitalizations. This is particularly relevant considering that these services are overwhelmed by the demands arising from the COVID-19 pandemic.[19]

High and equitable vaccination coverage is proven to be directly related to the provision of high-quality services, adapted to the needs of the different populations assisted.[27] Considering the results of this study, greater investments in PHC and PNI are emphatically recommended. This is especially relevant with regard to the adoption of new strategies, given the limitations imposed by the context of the pandemic. Such strategies include strengthening the target audience's active search for vaccination, expanding care services, encouraging adherence to vaccination, publicizing in the media the importance of seeking vaccines, as well as expanding and facilitating access to immunobiologicals. Alternatives such as drive-thru vaccination and home vaccination should also be considered.[4,28,29]

Furthermore, the implementation of these strategies must be guided by the specific needs of each region and state. It is also crucial to prioritize the most vulnerable populations, because of their greater exposure and risk of contagion not only from diseases such as polio, pneumococcal diseases and rotavirus, but also from COVID-19.[22]

In the Brazilian context, in addition to the demands arising from the pandemic, low vaccination coverage represents an emerging challenge to be faced. This is particularly relevant because of the significant importance of these diseases and their severity, which can worsen the public health situation in the country. This scenario could potentially further burden health services with diseases that could be prevented through immunization.

CONFLICT OF INTERESTS

Nothing to declare.

AUTHORS' CONTRIBUTIONS

RGN: Formal analysis, Conceptualization, Writing – original draft, Writing – review & editing, Methodology, Validation. YPV: Writing – original draft, Writing – review & editing, Validation. AOSJ: Writing – original draft, Writing – review & editing, Validation. MOS: Formal analysis, Conceptualization, Writing – original draft, Writing – review & editing, Methodology, Validation.

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