

Regional Inequalities in Rotavirus Vaccination Coverage During the COVID-19 Pandemic

Desigualdades Regionais da Cobertura Vacinal de Rotavírus Durante a Pandemia de COVID-19

Desigualdades Regionales en la Cobertura de Vacunación Contra el Rotavirus Durante la Pandemia de COVID-19

RESUMO

Objetivo: Analisar a variação da cobertura da vacina rotavírus no Brasil durante a pandemia de COVID-19, destacando as desigualdades regionais. **Método:** Estudo ecológico de série temporal com dados nacionais de imunização. Compararam-se as medianas de cobertura dos períodos 2007-2019 e 2020-2023 no país, regiões e estados. As diferenças foram avaliadas pelo teste de Mann-Whitney com significância de 5%. **Resultados:** A mediana nacional reduziu de 87,29% para 72,68%. Todas as regiões apresentaram reduções significativas, sobretudo Norte e Nordeste. **Conclusão:** A pandemia ampliou desigualdades pré-existentes na cobertura vacinal da vacina rotavírus, com maior impacto em territórios vulneráveis. A recuperação da cobertura depende de estratégias nos diferentes contextos regionais e do fortalecimento da Atenção Primária à Saúde para prevenir o aumento de casos graves por rotavírus e suas consequências.

DESCRIPTORES: Atenção primária à saúde; Cobertura vacinal; COVID-19; Desigualdades de saúde; Vacinas contra rotavírus.

ABSTRACT

Objective: To analyze the variation in rotavirus vaccine coverage in Brazil during the COVID-19 pandemic, highlighting regional inequalities. **Method:** Ecological time-series study with national immunization data. Median coverage for the periods 2007-2019 and 2020-2023 was compared for the country, regions, and states. Differences were assessed using the Mann-Whitney test with a significance level of 5%. Results: The national median decreased from 87.29% to 72.68%. All regions showed significant reductions, especially the North and Northeast. **Conclusion:** The pandemic amplified pre-existing inequalities in rotavirus vaccine coverage, with a greater impact on vulnerable territories. The recovery of coverage depends on strategies in different regional contexts and the strengthening of Primary Health Care to prevent an increase in severe cases of rotavirus and its consequences.

DESCRIPTORS: Primary health care; Vaccination coverage; COVID-19; Health inequalities; Rotavirus vaccines.

RESUMEN

Objetivo: Analizar la variación en la cobertura de la vacuna contra el rotavirus en Brasil durante la pandemia de COVID-19, destacando las desigualdades regionales. **Método:** Estudio ecológico de series temporales con datos nacionales de inmunización. Se comparó la cobertura mediana para los períodos 2007-2019 y 2020-2023 para el país, las regiones y los estados. Las diferencias se evaluaron mediante la prueba de Mann-Whitney con un nivel de significancia del 5%. **Resultados:** La mediana nacional disminuyó del 87,29% al 72,68%. Todas las regiones mostraron reducciones significativas, especialmente el Norte y el Nordeste. **Conclusión:** La pandemia amplificó las desigualdades preexistentes en la cobertura de la vacuna contra el rotavirus, con un mayor impacto en los territorios vulnerables. La recuperación de la cobertura depende de estrategias en diferentes contextos regionales y del fortalecimiento de la Atención Primaria de Salud para prevenir un aumento de casos graves por rotavirus y sus consecuencias.

DESCRIPTORES: Atención primaria de salud; Cobertura vacunal; COVID-19; Desigualdades en salud; Vacunas contra el rotavirus.

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Amanda Rezende Ruggio

Nursing student. Federal University of Minas Gerais (UFMG), Brazil.

ORCID: <https://orcid.org/0009-0006-6792-5915>



Amanda Tavares Ziviani Toledo

Nursing Student. Federal University of Minas Gerais (UFMG), Brazil

ORCID: <https://orcid.org/0009-0003-3010-1662>



Cynthia Márcia Romano Faria Walty

PhD in Nursing and Health. Federal University of Minas Gerais (UFMG), Brazil

ORCID: <https://orcid.org/0000-0003-3998-8418>

INTRODUCTION

Human rotavirus is the primary cause of acute viral gastroenteritis (AVG), which primarily affects children living in remote areas of developing countries where access to vaccination is limited⁽¹⁾. AVDs are part of the group of Acute Diarrheal Diseases (ADD), one of the leading causes of death in children under five years of age worldwide. Although it is declining, infant mortality from ADD still persists due to the severity of dehydration and malnutrition caused by these diseases⁽²⁾. In this context, basic sanitation measures, the use of oral rehydration solution, and, most importantly, vaccination are measures that reduce infant mortality from ADDs⁽¹⁾.

The Human Rotavirus Oral Vaccine (HROV) was incorporated into the Brazilian vaccination schedule in 2006 by the National Immunization Program (PNI). The recommended vaccination schedule consists of two oral doses, administered at 2 and 4 months of age, with the first dose (D1) able to be administered up to 11 months and 29 days, while the second dose (D2) can be administered up to 23 months and 29 days⁽³⁾.

Although the OPV is recommended nationally by the PNI, there are challenges to achieving adequate vaccination coverage. One of these was the onset of the COVID-19 pandemic, which overburdened health systems, resulting in the temporary interruption of various preventive measures, including immunization programs^(1,4).

It is estimated that in 2020, 23 million children worldwide missed one or more vaccines from the routine immunization schedule⁽⁵⁾. In Brazil, the National Immunization Program (PNI) had been showing a downward trend in coverage since 2015, a phenomenon associated with vaccine hesitancy, weaknesses in Primary Health Care (PHC), and reduced health funding⁽⁴⁾. The pandemic intensified this scenario, resulting in significant declines in coverage for several vaccines in the childhood immunization schedule, especially in the North and Northeast regions of the country, which already had low vaccination coverage even before the pandemic⁽⁶⁾.

Despite the importance of the HPV vaccine for the prevention of severe gastrointestinal complications, the national literature has gaps regarding the pandemic's impact on its coverage. International studies have demonstrated substantial reductions in the administration of multi-dose vaccines in 2020 and 2021, with varying impacts across countries and socioeconomic groups⁽⁵⁾. In Brazil, more recent analyses point to a sharp decline in childhood immunization coverage, including ROV⁽⁶⁾. However, details regarding the magnitude and geographical distribution of this reduction for the rotavirus vaccine remain scarce⁽¹⁾.

Given this scenario, the present study aims to analyze variations in rotavirus vaccination coverage in Brazil, comparing the pre-pandemic and pandemic periods, with an emphasis on regional and state differences.

METHOD

This is an observational ecological time-series study based on secondary data on ROVC vaccination coverage in Brazil. Data were obtained from the National Immunization Program (PNI), publicly available through the Department of Informatics of the Unified Health System (DATASUS). Data collection took place between January 2024 and January 2025, using the Health Information module (TABNET).

Data on vaccination coverage were included for the 27 Federal Units (UF) and the five major Brazilian regions, covering the entire period of VORH availability following its incorporation into the childhood vaccination schedule (2007–2023). For analytical purposes, the period was categorized into: pre-COVID-19 pandemic (2007–2019) and pandemic (2020–2023). Coverage was calculated according to the official PNI methodology: the number of doses administered according to the recommended schedule divided by the estimated target population for the year, multiplied by 100⁽⁷⁾.

The comparison between the pre-pandemic and pandemic periods was performed using the nonparametric Mann-Whitney test⁽⁸⁾, which was appropriate due to the asymmetric distribution of the variables, as determined by prior graphical assessment (histograms and boxplots). The significance level adopted was 5% ($\alpha = 0.05$). Additionally, the percentage change in the median between the periods was estimated, allowing for the measurement of the relative impact

of the pandemic on coverage trends.

All statistical analyses were conducted using Stata® software, version 18. The results were presented using measures of central tendency, dispersion, and comparative graphs.

Since the data are public, aggregated, secondary, and anonymized, the study does not require review by a Research Ethics Committee, in accordance with CNS Resolution No. 510/2016⁽⁹⁾.

RESULTS

In the period prior to the COVID-19 pandemic (2007 to 2019), the median vaccination coverage in Brazil was 87.29% (IQR 79.28–92.49), and during the COVID-19 pandemic (2020 to 2023), vaccination coverage decreased by 16.73%, reaching a median coverage of 72.68% (IQR 36.41–79.96) ($p=0.000$).

All regions showed a statistically significant

reduction in median vaccination coverage during the period of social distancing measures, ranging from 8.95% in the South ($p=0.000$) to 18.14% in the North ($p=0.000$).

Of the 26 states and the Federal District, 23 states showed a statistically significant reduction in median vaccination coverage, ranging from 7.05% in Rio Grande do Sul ($p=0.045$) to 33.94% in the state of Amapá ($p=0.001$) (Table 1).

Tabela 1- Mediana e variação percentual da mediana da cobertura da vacina Rotavírus aplicadas no Brasil antes e durante/ após as medidas de distanciamento social, Brasil, 2007 a 2023.

States and Regions	Median % (P25-P75)			
	Before	During	Change (%)	p*
	2007 a 2019	2020 a 2023		
BRAZIL	87,29 (79,28 - 92,49)	72,68 (36,41 - 79,96)	-16,73	0,000
NORTH	77,34 (71,13 - 88,24)	63,31 (36,38 - 73,73)	-18,14	0,000
Acre	73,49 (66,74 - 76,81)	64,90 (41,78 - 67,99)	-11,68	0,060
Amapá	75,48 (70,76 - 78,40)	49,86 (32,26 - 53,14)	-33,94	0,001
Amazonas	74,50 (64,13 - 80,24)	68,73 (43,18 - 71,70)	-7,74	0,350
Pará	71,51 (66,88 - 73,99)	61,71 (39,88 - 65,07)	-13,700	0,032
Rondônia	90,01 (88,69 - 96,62)	79,30 (50,05 - 83,25)	-11,89	0,003
Roraima	75,68 (72,10 - 86,72)	54,60 (34,20 - 66,42)	-27,85	0,023
Tocantins	88,73 (83,60 - 90,99)	82,14 (52,48 - 84,18)	-7,42	0,045
NORTHEAST	85,30 (78,53 - 89,86)	72,05 (43,22 - 75,25)	-15,53	0,000
Alagoas	83,29 (74,79 - 85,96)	77,82 (49,87 - 81,73)	-6,56	0,412
Bahia	77,68 (74,28 - 80,00)	67,77 (41,86 - 73,07)	-12,75	0,010
Ceará	94,95 (88,66 - 102,99)	79,12 (48,74 - 86,90)	-16,67	0,015
Maranhão	77,83 (72,82 - 82,88)	62,84 (41,19 - 66,33)	-19,25	0,006
Paraíba	87,41 (83,07 - 92,47)	71,12 (45,80 - 73,86)	-18,63	0,001
Pernambuco	90,52 (85,30 - 94,63)	70,94 (44,93 - 73,44)	-21,63	0,001
Piauí	84,10 (80,00 - 85,48)	72,69 (47,77 - 78,64)	-13,56	0,023
Rio Grande do Norte	82,55 (75,77 - 85,99)	74,24 (47,76 - 74,93)	-10,06	0,060
Sergipe	92,20 (88,18 - 93,08)	72,79 (46,22 - 76,25)	-21,05	0,001
MIDWEST	89,28 (85,84 - 94,42)	78,17 (49,31 - 81,83)	-12,44	0,000
Distrito Federal	88,30 (85,80 - 91,84)	77,89 (49,80 - 80,90)	-11,78	0,015
Goiás	88,42 (85,49 - 92,48)	76,82 (48,99 - 79,71)	-13,11	0,001
Mato Grosso	89,57 (85,63 - 91,85)	79,68 (50,57 - 82,37)	-11,04	0,015
Mato Grosso do Sul	93,44 (91,36 - 97,89)	80,22 (49,50 - 84,61)	-14,14	0,002

SOUTHEAST	91,65 (88,95- 94,90)	75,68 (39,70- 80,48)	- 17,42	0,000
Espírito Santo	93,64 (91,03 - 97,07)	78,11 (49,26 - 80,48)	- 16,58	0,001
Minas Gerais	93,79 (91,75 - 98,56)	80,03 (49,89 - 85,61)	- 14,67	0,001
Rio Janeiro	83,51 (78,90- 90,88)	57,42 (36,92- 58,68)	-31,24	0,001
São Paulo	90,79 (89,24- 93,84)	75,77 (48,03- 79,49)	- 16,54	0,001
SOUTH	91,64 (87,61- 95,80)	83,43 (51,43- 86,42)	-8,95	0,000
Paraná	91,64 (89,80- 93,20)	83,44 (52,82- 86,19)	-8,94	0,006
Santa Catarina	96,26 (94,03- 97,49)	87,02 (54,86- 89,93)	-9,59	0,003
Rio Grande do Sul	84,87 (83,88- 90,85)	78,88 (50,59- 82,54)	-7,05	0,045

Note: p= Percentile; * Mann-Whitney test (difference between medians).

DISCUSSION

The results show a significant decline in rotavirus vaccine coverage in Brazil during the COVID-19 pandemic (2020–2023), corresponding to a decrease of 16.73 percentage points compared to the pre-pandemic period. The magnitude of the observed decline is consistent with international and national findings, which point to substantial losses in childhood vaccination during the health crisis^(1,4,6).

Regional analysis revealed heterogeneous patterns, although all regions showed statistically significant declines. The largest reduction occurred in the North (–18.14%; $p=0.000$), a region with geographical barriers, lower service density, and greater socioeconomic vulnerability—historically hindering the maintenance of vaccination coverage⁽¹⁰⁾. Similar findings in Brazilian studies identified greater fragility of primary healthcare in the Northern Region during the pandemic⁽⁶⁾, as this Brazilian macro-region had the lowest percentage of rotavirus immunization in the country⁽¹⁾.

The decline in VORH coverage has significant epidemiological implications, particularly in regions with weaker socio-environmental infrastructure. Studies highlight the risk of hospitalizations and the reintro-

duction of controlled or eradicated diseases due to non-vaccination⁽¹¹⁾, and a national study reveals a 32% increase in mortality from acute diarrhea between 2018 and 2022⁽¹⁾.

Several factors contributed to the observed decline. The suspension of scheduled activities, prioritization of COVID-19 measures, shortage of healthcare professionals, fear of infection, and the deepening of socioeconomic inequalities drastically reduced the population's access to vaccination clinics⁽¹²⁾. Vaccine hesitancy, exacerbated by the circulation of misinformation regarding vaccine safety during the pandemic, also played a significant role⁽¹¹⁾.

The heterogeneity of results across states and regions underscores the decisive role of the primary healthcare (PHC) system, municipal response capacity, and local socioeconomic conditions in ensuring access to vaccination^(12,13), with the North and Northeast regions exhibiting greater vulnerability, supply shortages, and a lower capacity to reorganize services, corroborating national findings on inequalities in access to immunization^(1,4,10).

To restore vaccination coverage, micro-planning initiatives, strengthening of PHC teams, active search for children with vaccination delays, extended operating hours for vaccination clinics, and monitoring of indicators before, during, and after

vaccination campaigns are necessary. Furthermore, public policies should prioritize historically vulnerable regions, minimizing the effects of the pandemic and preventing future complications related to acute diarrheal diseases⁽¹³⁾.

CONCLUSION

This study revealed a statistically significant and unequal decline in rotavirus vaccination coverage during the COVID-19 pandemic in Brazil, with the greatest magnitude in the North and Northeast regions, intensifying historical inequalities in access to health services, including childhood immunization. The reduction in coverage represents an immediate epidemiological risk, given the severity of rotavirus diarrhea cases, especially among the most vulnerable populations. Therefore, immediate and sustained efforts, aligned with the country's specific socio-spatial characteristics, are crucial to reestablishing the recommended vaccination coverage.

REFERENCES

1. Amoroso MAR, Amoroso MHR, Silva CN, Arrais GLC, Barbosa CCH. The impact of the COVID-19 pandemic on rotavirus vaccination in the brazilian pediatric population. *Revista Eletrônica Acervo Científico*. 2023;46:15326.
2. Firmino MN, Câmara SBM, Cambraia ATDD, Mollo TL, Ferreira LA. Análise Epidemiológica da Mortalidade por Doenças Infecciosas Intestinais em Menores de Cinco Anos de 2018 a 2022 no Brasil. *Braz Journal of Implan and Health Sciences*. 2024; 6(7): 2388-2397.
3. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde e Ambiente. Departamento do Programa Nacional de Imunizações. Coordenação-Geral de Incorporação Científica e Imunização. Nota Técnica nº 193/2024-CGI-CI/DPNI/SVSA/MS: Atualização das indicações da vacina rotavírus humano G1P[8] (vacina rota) no Brasil. Brasília: Ministério da Saúde; 2024.
4. Neves RG, Vieira YP, Soares Junior AO, Saes MO. Cobertura das vacinas pneumocócica, contra poliomielite e rotavírus no Brasil: estudo descritivo, 2017 a 2020. *Rev Bras Med Fam e Comunidade*. 2023;18(45):3461.
5. Rodrigues RN, Nascimento GLM, Arroyo LH, Arcêncio RA, Oliveira VC, Guimarães EAA. Pandemia por COVID-19 e o abandono da vacinação em crianças: mapas da heterogeneidade espacial. *Rev Latino-Am Enfermagem*. 2022; 30:e3641.
6. Freitas NS, Mendes IBR, Moraes CG, Celere BS, Meschede MSC. Cobertura vacinal de rotavírus e hepatite A em uma região na Amazônia desprovida de saneamento satisfatório. *Rev Vigil Sanit Debate*. 2025; 13:e02284.
7. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde e Ambiente. Departamento do Programa Nacional de Imunizações. Nota Técnica nº 117/2024-DPNI/SVSA/MS: Regras de cobertura vacinal das vacinas do calendário nacional a partir de 2024. Brasília: Ministério da Saúde; 2024.
8. Contador JL, Senne ELF. Testes não paramétricos para pequenas amostras de variáveis não categorizadas: um estudo. *Rev Gest Prod*. 2016; 23(3):588-599.
9. Brasil. Ministério da Saúde. Conselho Nacional de Saúde. Resolução nº 510 de 7 de abril de 2016. *Diário Oficial da União*. Brasília (DF); 24 maio 2016 [citado 13 dez 2025]; Seção 1:44-46.
10. Barros RC, Shinkai RMG, Rodrigues AMC, Macedo BFS, Soares ACB. Avaliação da cobertura vacinal na região Norte do Brasil. *Brazilian Journ of Health Review*. 2021; 4(6).
11. Costa LP, Martins LM. Impactos da queda da cobertura vacinal na reintrodução de doenças imunopreveníveis: uma revisão da literatura. *Braz Journal of Implan and Health Sciences*. 2025; 7(2):12-27.
12. Rosa-Cómitre ACD, Campos AR, Silva FG, Jandoso B, Rodrigues CRC, Campos GWS. Processo de descaracterização da Atenção Primária à Saúde durante a pandemia no SUS, Campinas-SP, Brasil. *Ciê & Saúde Coletiva*. 2023; 28(12):3553-3562.
13. Souza JFA, Silva TPR, Duarte CK, Gryschek ALFPL, Duarte ED, Matozinhos FP. Estratégias para ampliação das coberturas vacinais em crianças no Brasil: revisão sistemática de literatura. *Rev Bras de Enferm*. 2024; 77(6):e20230343.