

## Acute Gastroenteritis Hospitalizations in Children with and without Risk Factors: Reflections on Rotavirus Vaccination in Portugal

### Internamentos por Gastroenterite Aguda em Crianças com e sem Fatores de Risco: Reflexão sobre a Vacinação contra o Rotavírus em Portugal

**Keywords:** Child; Gastroenteritis; Hospitalization; Risk Factors; Rotavirus Infections; Rotavirus Vaccines; Rotavirus; Vaccination

**Palavras-chave:** Criança; Fatores de Risco; Gastroenterite; Hospitalização; Infecções por Rotavírus; Rotavírus; Vacinação; Vacinas contra Rotavírus

Dear Editor,

We are writing in response to the article by Lucaccioni *et al*, "Burden and Trends of Severe Rotavirus Infections and All-Cause Acute Gastroenteritis Hospital Episodes in Children Under Five Years Old in Mainland Portugal," published in 2021, to offer additional insights.<sup>1</sup> This paper provides valuable data as the first nationwide analysis of rotavirus (RV) and gastroenteritis (AGE) hospital episodes in children under five years old in Portugal. The study is particularly relevant given the introduction of RV vaccination into the National Immunization Program in October 2021, targeting children with specific risk factors.<sup>2</sup>

While a vaccination strategy targeting high-risk groups is considered cost-effective in low RV prevalence settings,<sup>3</sup> there is a lack of literature on the impact of high-risk groups on RV burden in Portugal.

To address this, we conducted a retrospective analysis, using the same administrative database from the Central Authority for Health Systems as Lucaccioni *et al*, extending the period from 2000 to 2017. We aimed to characterize AGE hospitalizations in children under five years of age according to the presence or absence of risk factors defined by national RV vaccination guidelines. Direct costs per hospitalization were estimated using a diagnosis-related groups model, aligned with the Portuguese National Health Service reimbursement system.<sup>4</sup>

We identified 47 326 hospitalizations (6.6% of all hospitalizations in this age group), with at least one risk factor identified in 2.7% of cases. Children with risk factors were more frequently diagnosed with RV infection, had higher rates of complications (shock/sepsis, ventilation), and experienced a four-fold longer hospital stay, with a 22-fold higher mortality rate. Estimated mean hospitalization costs more than doubled in this group (€2912.15 vs €1217.99,

$p < 0.001$ ). Total direct costs over the 18 years reached €59.7 million.

The Portuguese and European Societies of Pediatrics and Pediatric Infectious Diseases,<sup>5,6</sup> along with the World Health Organization,<sup>7</sup> advocate for universal vaccination, as specific high-risk groups for severe RV AGE cannot be clearly defined.<sup>6</sup> Although these patients experience disproportionately severe outcomes and incur higher healthcare costs, they comprise a minority of AGE hospitalizations. Universal vaccination could offer broader protection and reduce overall hospitalizations. However, its cost-effectiveness must be carefully weighed, particularly in countries like Portugal where severe outcomes are relatively infrequent.<sup>3</sup> Our findings provide data crucial for evaluating the current national strategy of vaccination, focused on high-risk groups.

#### AUTHOR CONTRIBUTIONS

LLA: Data collection and analysis, literature review, writing of the manuscript.

RL, IA: Critical review of the manuscript.

AF: Data collection and analysis, critical review of the manuscript.

All authors approved the final version to be published.

#### PROTECTION OF HUMANS AND ANIMALS

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the Helsinki Declaration of the World Medical Association updated in October 2024.

#### DATA CONFIDENTIALITY

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

#### COMPETING INTERESTS

The authors have declared that no competing interests exist.

#### FUNDING SOURCES

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

#### REFERENCES

1. Lucaccioni H, Machado RS. Burden and trends of severe rotavirus infections and all cause acute gastroenteritis hospital episodes in children under five years old in mainland Portugal. *Acta Med Port*. 2021;34:669-76.
2. Direção-Geral da Saúde. Programa nacional de vacinação 2020: vacinação contra gastroenterite por rotavírus de crianças pertencentes a grupos de risco. 2021. [cited 2022 Jan 10]. Available from: <https://www.dgs.pt/normas-orientacoes-e-informacoes/normas-e-circulares-normativas/norma-n-0072021-de-15102021-pdf.aspx>.
3. Bruijning-Verhagen P, van Dongen JA, Verberk JD, Pijnacker R, van Gaalen RD, Klinkenberg D, et al. Updated cost-effectiveness and risk-benefit analysis of two infant rotavirus vaccination strategies in a high-income, low-endemic setting. *BMC Med*. 2018;16:168.
4. Portugal. Portaria 839A-2009. Diário da República, I Série, n.º 147/2009 (2009/07/31). p. 4978(2)-(124).
5. Comissão de Vacinas da Sociedade de Infeciologia Pediátrica (SIP) e Sociedade Portuguesa de Pediatria (SPP). Recomendações sobre vacinas extra programa nacional de Vacinação. 2020. [2020 Sep 24].

Available from: [https://www.spp.pt/UserFiles/file/Comissao\\_de\\_Vacinas/Recomendacoes%20vacina%20pneumococcica%20verso%20final.pdf](https://www.spp.pt/UserFiles/file/Comissao_de_Vacinas/Recomendacoes%20vacina%20pneumococcica%20verso%20final.pdf).

6. Dornbusch HJ, Vesikari T, Guarino A, LoVecchio A, Hadjipanayis A, Koletzko B. Rotavirus vaccination for all children or subgroups only? Comment of the European Academy of Paediatrics (EAP) and

the European Society for Paediatric Infectious Diseases (ESPID) recommendation group for rotavirus vaccination. Eur J Pediatr. 2020;179:1489-93.

7. World Health Organization. Rotavirus vaccines. Wkly Epidemiol Rec.2021;28:301-20.

**Table 1** – Characteristics of hospitalized patients with acute gastroenteritis, with and without risk factors, between 2000 and 2017

	With risk factors	Without risk factors	p-value
<b>Total hospitalizations for AGE, n (%)</b>	1283 (2.7%)	46 043 (97.3%)	
<b>Age, n (%)</b>			< 0.001
0 - 6 months	392 (30.6%)	7864 (17.1%)	
6 - 12 months	251 (19.6%)	10 092 (21.9%)	
12 - 24 months	293 (22.8%)	12 892 (28.0%)	
24 - 36 months	149 (11.6%)	6920 (15.0%)	
36 - 48 months	115 (9.0%)	4570 (9.9%)	
48 - 60 months	83 (6.5%)	3705 (8.0%)	
<b>Sex, n (%)</b>			0.988
Male	712 (55.4%)	25 561 (55.4%)	
Female	571 (44.5%)	20 482 (44.5%)	
<b>Hospital Location (NUTS2), n (%)</b>			< 0.001
North	438 (34.1%)	18 819 (40.9%)	
Center	273 (21.3%)	10 225 (22.2%)	
Lisbon	503 (39.2%)	13 786 (29.9%)	
Alentejo	53 (4.1%)	2535 (5.5%)	
Algarve	16 (1.2%)	678 (1.5%)	
<b>Etiology, n (%)</b>			< 0.001
Viral	649 (50.6%)	19 548 (42.5%)	
Rotavirus	389 (30.3%)	10 486 (22.8%)	
Bacterial	113 (8.8%)	6499 (14.1%)	
Parasitic	22 (1.7%)	199 (0.4%)	
Unspecified	512 (39.9%)	20 062 (43.6%)	
<b>Length of stay</b>			< 0.001
Mean $\pm$ SD (days)	16.7 $\pm$ 49.5	4.1 $\pm$ 8.9	
Median [IQR] (days)	6 [3 - 13]	3 [2 - 5]	
<b>Hospital mortality, n (%)</b>	14 (1.1%)	24 (0.05%)	< 0.001
<b>Complications</b>			
Shock/sepsis	31 (2.4%)	149 (0.3%)	< 0.001
Ventilation	80 (6.2%)	145 (0.3%)	< 0.001
<b>Estimated costs (DRG)</b>			< 0.001
Mean $\pm$ SD (euros)	€2912.15 $\pm$ €5743.87	€1217.99 $\pm$ €1643.47	
Median [IQR] (euros)	€1552.29 [€1018.17 - 2533.32]	€964.97 [€964.97 - 1166.73]	

Data are presented as numbers and percentages (n, %) or as means with standard deviations (Mean  $\pm$  SD). Median and interquartile ranges (IQR) are also reported where applicable. Statistical significance was determined using p-values, which correspond to chi-square tests comparing the overall distribution between groups across all subcategories. AGE: acute gastroenteritis; DRG: diagnosis-related groups; IQR: interquartile range; NUTS2: nomenclature of territorial units for statistics level 2; SD: standard deviation.

Laura LEITE-ALMEIDA<sup>1</sup>, Rui LEITE<sup>2,3</sup>, Alberto FREITAS<sup>4</sup>, Inês AZEVEDO<sup>1,5</sup>

1. Serviço de Pediatria. Unidade Local de Saúde de São João. Porto. Portugal.

2. Centro de Estudos e Formação Avançada em Gestão e Economia (CEFAGE). Universidade de Évora. Évora. Portugal.

3. Centro de Economia e Finanças (CEFUP). Faculdade de Economia. Universidade do Porto. Porto. Portugal.

4. RISE-Health. Departamento de Medicina da Comunidade, Informação e Decisão em Saúde (MEDCIDS). Faculdade de Medicina. Universidade do Porto. Portugal.

5. RISE-Health. Departamento de Ginecologia-Obstetrícia e Pediatria. Faculdade de Medicina. Universidade do Porto. Portugal.

✉ Autor correspondente: Laura Leite de Almeida. [analaurlalmeida@gmail.com](mailto:analaurlalmeida@gmail.com)

Recebido/Received: 31/01/2025 - Aceite/Accepted: 10/07/2025 - Publicado/Published: 01/09/2025

Copyright © Ordem dos Médicos 2025

<https://doi.org/10.20344/amp.22954>

