

# Epidemio-Clinical Profile of Acute Diarrhea in Children From 0 To 5 Years and Prevalence of Rotavirus Before and After the Introduction of the Rotasiil Vaccine in the Democratic Republic of Congo.

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## Analysis article

## Open Access &

## Peer-Reviewed Article

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## Keywords:

Diarrhea, after and before  
vaccine, Rotavirus, Kinshasa, DRC.

**Received:** May 07, 2023

**Accepted:** July 06, 2023

**Published:** July 14, 2023

## Academic Editor:

Raul Isea ,Fundación Instituto de Estudios  
Avanzados -IDEA.

## Citation:

Freddy Mboko Byamungu, Loukia Paizanos Aketi, Joseph Diayisu Shiku, Joëlle Nzuzi Bemba, Rosette Kevaani Lepira et al. (2023) Epidemio-Clinical Profile of Acute Diarrhea in Children From 0 To 5 Years and Prevalence of Rotavirus Before and After the Introduction of the Rotasiil Vaccine in the Democratic Republic of Congo.. Journal of Diseases - 1(1):15-24.

## Abstract

### Introduction

Acute diarrhea remains one of the major health problems in developing countries. According to the WHO, rotavirus contributes to approximately 40% hospitalizations and is the leading cause of severe diarrhea in children 0-5 years old.

The objective was to determine the prevalence of rotavirus and the sociodemographic and clinical profile among children with diarrhea in 4 hospitals in the DRC.

### Methods

This study is documentary, retrospective and analytical taking two periods, before and after introduction of the vaccine, i.e. January 2017 to December 2018 and January 2020 to December 2021 in 4 hospitals, i.e. 2 in Kinshasa and 2 in Lubumbashi.

### Results

Total 1872 children, 924 (49.4%) of whom were enrolled before the introduction of the vaccine and 948 (50.6%) after. Only 1737 had performed serology, of which 875 (50.4%) were rotavirus positive and 862 (49.6%) were negative. Positive results, a reduction of 30.6% is noted since the introduction of the vaccine. The predominant age range was 6 to 11 months. The male gender was predominant at 56.7%.

Diarrhea was found in 88.5%, vomiting in 73.7% and fever in 73.9%. Before vaccination, the risk was more: 11 times to have diarrhea, 9-10 times the frequency between 3-10 times a day, 9 times vomiting, 2 times fever and 2 times to have a positive result.

### *Conclusion*

From this study, we note a reduction frequency due to diarrhea unlike previous years, probably attributable to the vaccine.

### **Introduction**

Acute diarrhea remains one of the major public health issues in a number of developing countries. According to the World Health Organization (WHO), rotavirus contributes to around 40% of hospitalizations and the main cause of severe diarrhea in under five children worldwide [1].

It is associated with the death of more than 600,000 children under the age of 5 per year worldwide, the most affected of which are malnourished infants living in disadvantaged, low-income rural areas, where access to health care is poor [1, 2, 3, 4].

Since 2006, rotavirus vaccines have been recommended for all countries by the World Health Organization (WHO). In 2009, more than 100 countries, including six with a high burden of disease (Afghanistan, Angola, Ethiopia, India, Kenya and Pakistan) introduced a rotavirus vaccine into their vaccination program [5, 6, 7].

The Democratic Republic of Congo (DRC) introduced the Rotasiil vaccine into its immunization schedule in 2019 [12,13]. But few studies have assessed the impact of vaccination on the prevalence of rotavirus and the clinical profile of diarrhea. Thus this study aimed to determine the prevalence of rotavirus among children with diarrhea and the description of the sociodemographic and clinical profile of children from 0 to 5 years old with diarrhea in 4 hospitals in the DRC.

### **Methods**

It's a documentary, retrospective and analytical study which took into account two periods, before and after introduction of the rotasiil vaccine, i.e. from January 2017 to December 2018 and from January 2020 to December 2021. It took place in 4 hospital structures, i.e. 2 in Kinshasa, the capital of the DRC and 2 in Lubumbashi, the 2nd largest province of the country. In addition, these health structures had received support in diagnostic tools as part of rotavirus surveillance. The data was collected exhaustively and consecutively on the basis of consultation registers, patient files and laboratory registers.

All records of infants and children under 5 years of age who presented with diarrhea lasting less than 1 week were included in the study. Two stool samples were taken 2 days apart in these children, in 2 jars, within 48 hours of their admission for a SANDWICH ELISA serological test. We're not included all the children who had not carried out the serological test or those who did not have stool results available or those whose medical records were not found. Socio-epidemiological (age, sex, origin, month of consultation) and clinical (fever, vomiting, diarrhea with its frequency, appearance and duration) data were collected. Data were analyzed using SPSS 26.0 software. Quantitative variables were summarized by the median with their interquartile spaces, categorical ones were presented as relative frequencies/percentage and Pearson's chi-square test or Fisher's test was used for the comparison of proportions. The  $p < 0.05$  value was considered statistically significant. The study had received the approval of the ethics committee of the school of public health under the number ESP/CE/36/2022. The confidentiality of our results was guaranteed.

## Results

A total of 924, or 49.4%, of children were enrolled before the introduction of the vaccine and 948, or 50.6% after the introduction of the vaccine, giving a total of 1,872 cases. Of this number, only 1737 had taken the serological test, of which 875 (50.4%) had a positive result for rotavirus and 862 (49.6%) had a negative result.

However, from these positive results before and after vaccination, there is a reduction of 30.6% since the introduction of the Rotasiil vaccine in the DRC.

Regarding children with diarrhea according to the sites, the provincial city of Kinshasa had registered 1,360 children, i.e. 72.6% and the city of Lubumbashi recorded 512 children, i.e. 24.6%.

The median age of the patients was 8 months (6 to 12 months of interquartile space). The predominant age range was 6 to 11 months. (Table I)

The male sex was predominant with 1061 cases (56.7%) against 811 (43.3%) of female sex. The sex ratio was 1.3 in favor of boys.

Table 1. Distribution by age

Variables	Effectifs (n=1872)	%
Age of children (Median, EIQ)	8 months (6– 12months)	
Children's age range		
0-5 months	465	24,8
6-11 months	879	47,0
12-23 months	434	23,2
24-60 months	94	5,0

The socio-demographic data were presented according to the periods of the study (Table II).

The results showed a significant association with age and Kinshasa city, while gender had no significant statistical value.

In order to highlight the seasonality of the disease, the frequency of patients was presented monthly during the 2 periods of the study, namely, before and after vaccination. The figure below shows the trend.

We note that before the introduction of the vaccine, the frequency generally decreased from January to December, while the opposite trend was observed after the introduction of the Rotasiil vaccine.

As for the clinical characteristics, in our series, diarrhea, vomiting and fever are the dominant symptoms in all children. Moderate to severe diarrhea being found in the majority of cases 88.5%, vomiting in 73.7% of cases and fever in 73.9% of cases.

The association between clinical characteristics and vaccination is presented in Table 3.

Note that children before vaccination were 11 times more likely to have diarrhea than after the vaccine. And the risk of having diarrhea between 3-10 times was 3 times, even 9-10 times greater before than after the introduction of the vaccine.

Table 2. Association between sociodemographic characteristics and vaccination

Variables	Vaccine		P
	Before n(%)	After n(%)	
<b>Children's age range</b>			<b>0,00*</b>
0-5 months	269 (29,1%)	196 (27%)	
<b>6-11 months</b>	441 (47,7%)	438 (46,2%)	
12-23 months	175 (18,9%)	259 (27,3%)	
<b>24-59 months</b>	39 (4,2%)	55 (5,8%)	
<b>Gender of child</b>			
<b>Male</b>	527 (57,0%)	534 (56,3%)	0,78
Female	397 (43,0%)	414 (43,7%)	
<b>City of origin</b>			
<b>Kinshasa</b>	634 (68,6%)	726 (76,6%)	0,00*
<b>Lubumbashi</b>	290 (31,4%)	222 (23,4%)	

Figure 1. Seasonality in relation to the 2 periods of the study

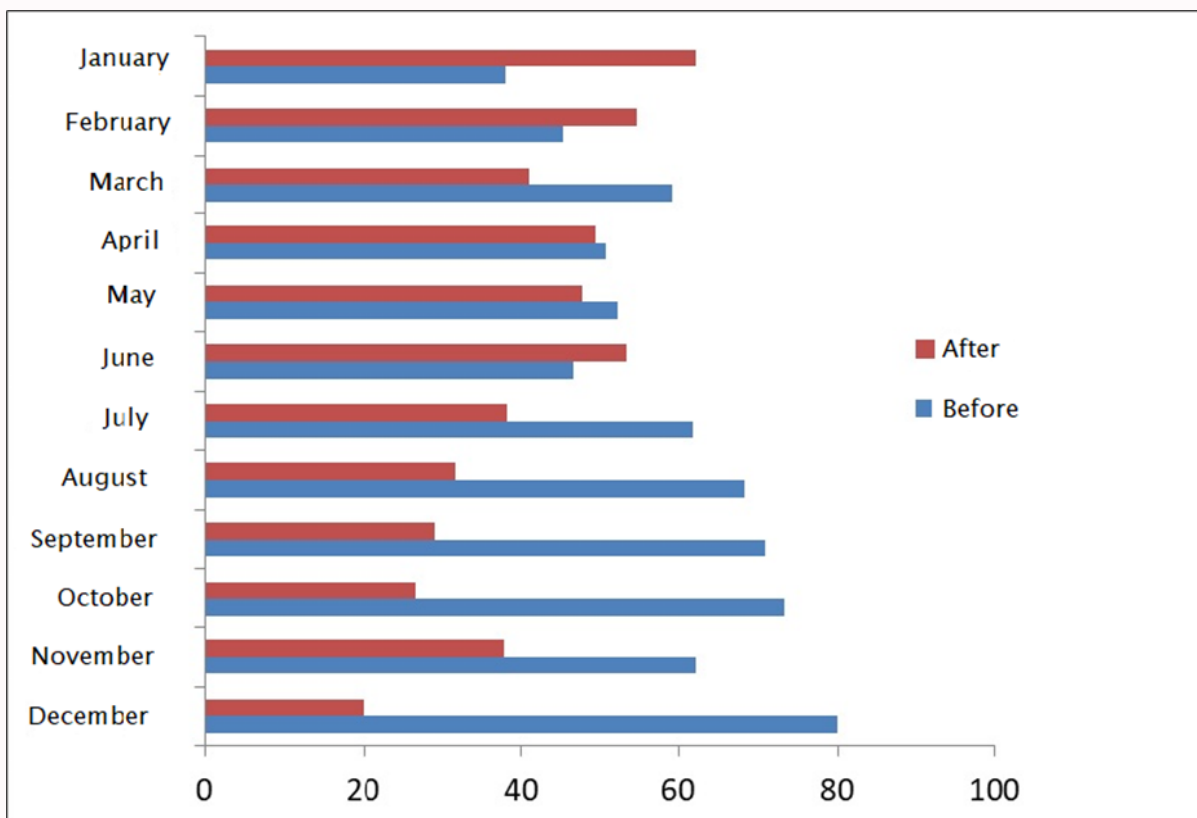


Table 3. Association between clinical characteristics and vaccination

Vaccine				
Variables	Before N (%)	After N (%)	IC 95%	P
<b>Notion of diarrhea</b>				
Yes	903 (97,7%)	754 (79,5%)	11,1 (7,0 ; 17,5)	0,00*
No	21 (2,3%)	194 (20,5%)	1	
<b>Frequency of diarrhea by day</b>				
1-2 times	238 (25,8%)	479 (50,5%)	1	
3-10 times	677 (73,3%)	467 (49,3%)	2,9 (2,4 ; 3,5)	0,00*
> 10 times	9 (1,0%)	2 (0,2%)	9,1 (1,9 ; 42,2)	<0,01*
<b>Notion of vomiting</b>				
Yes	852 (92,2%)	527 (55,6%)	9,5 (7,2 ; 12,4)	0,00*
No	72 (7,8%)	421 (44,4%)	1	
<b>Notion of fever* (n=1684)</b>				
Yes	773 (84,9%)	611 (79,0%)	1,5 (1,2 ; 1,9)	0,02*
No	138 (15,1%)	162 (21,0%)	1	
<b>ELISA Test * (n=1737)</b>				
Positive	521 (57,8%)	354 (42,3%)	1,9 (1,5 ; 2,3)	0,00*
Negative	380 (42,2%)	482 (57,7%)	1	

The risk of having an episode of vomiting was 9 times greater before vaccination than after. And the risk of fever was twice as great before the introduction of the vaccine as after it. The risk of having a positive result was twice as great before the introduction of the vaccine as after. (Table III).

### Discussion

Acute diarrhea remains one of the major public health issues in a number of developing countries. According to the World Health Organization (WHO), rotavirus contributes to around 40% of hospitalizations and the main cause of severe diarrhea in under five children worldwide. The objective was to determine

the prevalence of rotavirus and the sociodemographic and clinical profile among children with diarrhea in 4 hospitals in the DRC. To achieve this, we conducted the study of certain socio-demographic parameters and prevalence.

### *Frequency*

During our study, 1872 children aged 0-5 years were enrolled, i.e. 38% compared to the study carried out by Luhata et al. [14] from 2009-2019, i.e. 10 years, and who had enrolled 4,928 out of 4,952 (99.5%), there is a significant hospital reduction of 61.5% in cases of diarrhea recorded in the sentinel sites. This reduction is similar to those reported by Parveen Fathima et al. in Australia (66-79%). And, comparing the two periods, significant decreases were observed in children aged less than 12 months by 66% and between 12 and 23 months by 57% [15]. It is also similar to that observed in Spain by Monica Lopez-Lacort which decreased with age, by 72% and 58% respectively in two-year-old children compared to those less than one-year-old [16]. This reduction is far superior to that observed in Rwanda (17-29%) despite a very significant reduction in Rotavirus diarrhea after the introduction of the vaccine [17] and vaccination coverage reaching more than 95% and in Spain (20%) where a low vaccination coverage in Europe (50%) was noted. The average reduction observed in Sub-Saharan Africa is 25-42% [18-21].

A study carried out in Afghanistan (highly affected country) showed that vaccination against Rotavirus has the potential to prevent more than one million cases; 660,000 outpatient visits; approximately 50,000 hospital admissions; 650,000 DALYs; and 12,000 deaths, over 10 years. This high frequency in our study would certainly be correlated with the presence of the vaccine.

### *Age and Sex*

#### *A. Age*

The most affected age group was 6 - 11 months (47%), followed by 0 - 5 months (24.8%) and both accounted for 71.8% of children.

This result is similar by Luhata but also by many other authors [14,22-25] and the literature [3,4].

This young age implies the time of exclusive breastfeeding recommended, the introduction of a varied diet with the risks that accompany it.

This highlights the importance of protective immunoglobulins in breast milk in preventing acute Rotavirus infections.

#### *B. Sex*

Diarrhea was more common in male children than in female children. This is consistent with the Luhata study and in several community studies [14,26].

### *According to Seasonality*

In our series, the month from May to September is the most critical period, corresponds to the rotavirus season.

This result is similar to that found by Luhata and in Rwanda but also the literature [4,17].

### *Clinical features*

In our series, diarrhea, vomiting and fever are the dominant symptoms in all children.

Diarrhea being found in the majority of cases 88.5%, vomiting 73.7% and 73.9% presented fever. This

result converges with the literature [1,4,6,8,27-28] and Luhata: 100% diarrhea and 92% vomiting. Several infectious episodes (1-4) increase immunity and reduce the risk of subsequent diarrhea, especially that due to Rotavirus.

Comparing with the study carried out by Luhata on Rotavirus positivity before the introduction of the vaccine (60%), there is a small difference in our study, 57.8%. This rate is far higher than those observed in many African countries such as Kenya (26%), Gambia (22%), Ethiopia (23%), Benin (39.9%), Cote d'Ivoire (28.8%) and RSA (24%).

This reduction is far from the reduction rate nevertheless of certain countries of the continent like, Rwanda, 17-29% reduction in hospitalization due to diarrhea and 61-70% reduction due to Rotavirus (Vaccination rate between 98- 99%), in Ghana [5], a reduction ranging from 74.2% to 43.9%, in Madagascar where before the introduction of the vaccine, 56% of positive samples fell from 13% in 2015, 12% in 2016 [27.29.30]

In Pakistan, current trends note a halving of deaths due to AVR diarrhea [31]. But also from some Asian countries such as India, 43.6% [32].

In our study, a 30.6% reduction was observed when comparing positive results before and after vaccination. This weakness is probably linked to the low vaccination rate in the DRC as in the majority of developing countries [10,11,13,14]. It is however close to that observed in Spain (36%), in Belgium, 32-43% against 55% before the introduction of the vaccine, in Turkey (45%), in Nigeria, 25-35% against 66% before the vaccine introduction [27-28].

Compared to the reduction in hospitalization for diarrhea before and after vaccination, this weakness is to be considered globally in the countries of Africa and Asia (17-50%) compared to the developed countries of Europe and America (50-70% and 85-98% respectively intermediate and developed countries [33].

This study evaluated the epidemiological and clinical aspects of diarrhea after the introduction of the Rotasiil vaccine into the vaccination schedule in the DRC. It was limited by the fact of having only taken into account the hospitals of Kinshasa and Lubumbashi and not having emphasized the vaccination status of the children enrolled in this study and the strains of rotavirus identified.

### Conclusion

The Democratic Republic of Congo, like many other countries on the continent, have introduced the vaccine against Rotavirus (Rotasiil) into their vaccination schedule. At the end of this study, we noted a reduction in frequency due to diarrhea unlike previous years, this is probably attributable to the presence of the vaccine and the age group under 12 months pays the greatest burden. of this pathology.

### Declaration of interests

The authors declare that they have no competing financial interests or known personal relationships which might appear to influence the work reported in this article.

### Contribution of the authors

1. **BYAMUNGU MBOKO Freddy:** design, writing of the work and data collection,
2. **AKETI PAIZANOS Loukia:** supervision and writing of the work,
3. **SHIKU DIAYISU Joseph:** work supervision,
4. **Dr NSIMBA BEMBA Joëlle,** support for data collection,

5. Dr KEVAANI LEPIRA Rosette, support for data collection,

6. Dr KIFUTU MATULA Irene, support for data collection,

7. Éric TSHITONA KALULI, support for data collection.

### Thanks

We also appreciate the contribution of all the sentinel teams (nurses, laboratories and data managers) who not only allow the implementation of these surveillance activities in the field which have made the data available to us.

We would also like to thank the INRB team who contributed to making the database available to us, but also the families of the children for their passage through the care structures contributed to obtaining this data.

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