Open Journal of Epidemiology, 2026, 16(3), 515-524
https://www.scirp.org/journal/ojepi
ISSN Online: 2165-7467
ISSN Print: 2165-7459

Rotavirus Surveillance and Impact of Vaccination at the Gaoua Regional Hospital, Burkina Faso, from 2013 to 2022

Pauline Kiswendsida Yanogo[1,2*], Estelle Nadine Sanou[2], Nikiema Morou[3], Nicolas Meda[1,2]

[1]Department of Public Health, Health Sciences Research and Training Unit, Joseph Ki-Zerbo University, Ouagadougou, Burkina Faso
[2]Burkina Field Epidemiology and Laboratory Training Program, Health Sciences Research and Training Unit, University Joseph Ki-Zerbo, Ouagadougou, Burkina Faso
[3]Health District of Ouargaye, Ministry of Health, Ouargaye, Burkina Faso
Email: *y_poline@yahoo.fr

How to cite this paper: Yanogo, P.K., Sanou, E.N., Morou, N. and Meda, N. (2026) Rotavirus Surveillance and Impact of Vaccination at the Gaoua Regional Hospital, Burkina Faso, from 2013 to 2022. *Open Journal of Epidemiology*, **16**, 515-524.
https://doi.org/10.4236/ojepi.2026.163034

Received: May 31, 2026
Accepted: August 25, 2026
Published: August 28, 2026

Abstract

Background: Rotaviruses are the leading cause of severe diarrhoea with dehydration in young children and are the fourth leading cause of childhood mortality worldwide. This study aimed to describe the epidemiological profile, determine diagnostic time, performance indicators and the impact of rotavirus vaccine in children. **Subjects and Method:** This is a cross-sectional, analytical study of rotavirus surveillance data from the Gaoua sentinel site in 2135 children aged 0 to 59 months from 2013-2022 of whom 784 did not undergo ELISA testing. Microsoft Excel and Epi Info 7.2.2.6 were used for data analysis. Proportions, means, and medians were calculated. An univariable logistic regression was performed using a liberal significance threshold of $p \leq 0.20$, followed by a multivariable logistic regression with a conventional threshold of $p \leq 0.05$, in order to estimate the adjusted odds ratio (ORa) and the preventive fraction. **Results:** The prevalence was 27.10%. The 0 - 11-month age group was most affected (48.09%). The sex ratio was 1.56 Male/Female. The consultation, hospitalization and diagnosis times are respectively 3, 4 and 27 days. The performance indicators of rotavirus surveillance are 98.26% for the rate of samples collected, vaccination coverage was 80.14% among suspected rotavirus cases and 68.58% among confirmed cases, and 63.27% of tests carried out. Vaccine efficacy is 36% CI [12 - 53] (ORa = 0.644) ($p = 0.0065$). **Conclusion:** Rotavirus diarrhoea remains common in Burkina Faso. Vaccination coverage and testing rates are below the threshold required by the health system. The delay in diagnosis due to the health system is long. We recommend strengthening routine vaccination activities and diagnostic capacities.

Keywords

Rotavirus, Vaccination, Surveillance, Burkina Faso

1. Introduction

Rotavirus infection represents a major public health issue, especially in Burkina Faso. Indeed, global surveillance data show that nearly 40% of hospitalizations due to diarrhoea in children under 5 years of age are linked to rotavirus [1]. Thus, rotavirus is the leading cause of severe diarrhoea with dehydration in children under 5 years of age and ranks fourth as a cause of childhood mortality worldwide [2]-[4]. According to the World Health Organization (WHO) report, the annual number of childhood deaths due to rotavirus worldwide from 2013 to 2017 was between 122,000 and 215,000 [5]. In addition, 258 million cases and 128,500 deaths were from rotavirus in 2016. The burden is high in developing countries [6] [7]. In 2016, approximately 117 million episodes of rotavirus-associated diarrhoea occurred in sub-Saharan Africa, including approximately 104,000 deaths [8].

To strengthen the fight against rotaviruses, WHO is coordinating a global surveillance network that uses standardized case definitions and laboratory methods in sentinel hospitals to identify rotavirus cases in children with diarrhoea [9]. Burkina Faso established this surveillance network and expanded it to four sentinel sites in December 2013. However, although the burden of rotavirus disease has decreased considerably compared to 2000, its incidence remains high in Burkina Faso [10]. According to the 2020 statistical yearbook of the Ministry of Health and Public Hygiene, non-bloody diarrhoea is a reason for consultation in 690,422 children under 5 years of age in basic health facilities.

Few studies have analysed sentinel surveillance data on rotavirus in Burkina Faso. The latest study published was conducted in 2017 by Bonkoungou *et al.* It did not determine the performance indicators for rotavirus surveillance. In addition, Burkina Faso has changed the type of vaccine it uses. It switched from Rotateq to Rotasiil in 2020. Our study therefore aims to analyse rotavirus epidemiological surveillance in order to determine the data prevalence of rotavirus, describe its epidemiological profile, determine the impact of vaccination, and determine the level of performance indicators for its system surveillance.

2. Methodology

2.1. Study Setting

Burkina Faso has four sentinel sites for rotavirus surveillance. The Gaoua Regional Hospital (CHRG) is in the southwest region of Burkina Faso. It initiated sentinel rotavirus surveillance in December 2013 and has not experienced any interruptions. According to rotavirus database surveillance data from 2020 and 2021, the Gaoua sentinel site represents the site that has reported the most cases.

2.2. Concept of the Study

This was a cross-sectional study with the aim of analysing rotavirus surveillance data from the Gaoua sentinel site from October 2013 to June 2022.

2.3. Study Population and Sampling

The study population consisted of all cases of acute diarrhoea, notified to the CHRG in the rotavirus database, from October 2013 to June 2022.

Suspected case (or case of acute diarrhea): Any child (generally 0 to 5 years old, or 0 to 59 months) hospitalized for acute diarrhea (sudden onset of loose or watery stools, distinct from normal bowel movements, lasting less than 7 days) (Sentinel surveillance plan for rotavirus in Burkina Faso).

Inclusion criteria: All children aged 0 - 59 months meeting the sentinel case definition for acute diarrhoea and recorded in the national rotavirus surveillance database during the study period.

Exclusion criteria: No cases were excluded from the descriptive analyses. However, for analyses requiring laboratory confirmation, particularly the estimation of rotavirus prevalence, suspected cases without an ELISA test result (n = 784) were excluded because their rotavirus status could not be determined. Sampling was exhaustive, including all eligible cases, n = 2135.

2.4. Study Variables

Time variable: Quarter (1 - 4), date of onset of symptoms, date of consultation, date of ELISA test, date of ELISA test result, date of hospitalization, date of Exeat,

Person: Age (0 - 59 months), sex (male, female),

Performance indicators variables according to health surveillance in Burkina Faso (Directorate of Vaccination Prevention): Vaccination (Yes, No), staff capacity to photocopy booklets (Yes, No), ELISA test performance (Yes, No), and sample collected (Yes, No).

2.5. Data Collection

This was data collected in July 2022 from the acquired databases from the Ministry of Health and Public Hygiene using a data extraction grid. These data were previously collected by health workers from children aged 0 - 5 years, in the CHRG sentinel site, using rotavirus case investigation forms from October 2013 to June 2022. The child's vaccination status was verified through examination of the vaccination record. They were entered into Epi Info 3.0 using the WHO rotavirus surveillance system database. For laboratory testing, stool samples were collected within 48 hours of admission and stored at 2˚C - 8˚C (if tested within 1 week) or −20˚C (if tested >1 week) before being transferred to the Burkina Faso National Public Health Laboratory by Poste Burkina, where rotavirus testing was performed. Samples were tested using a commercially available enzyme immunoassay (EIA; ProSpecT, Oxoid, Cambridge, UK). The specimens were stored at −70˚C at the National Public Health Laboratory of Burkina Faso.

2.6. Data Management and Analysis

Data processing consisted of merging the database of the last 10 years and identifying missing, outlier, and inconsistent data. Excel ® 2016 and Epi Info 7.2.2.6 were used to analyse the data. The proportions, mean, median, and impact measurement (preventive fraction) were calculated. Rotavirus prevalence was calculated using only children who underwent ELISA testing, with positive cases in the numerator and the total number tested in the denominator. This approach ensures methodological rigor, as untested children cannot be classified virologically and therefore are excluded from prevalence estimates. Vaccination coverage rate: number of vaccinated cases in the total study population. Patient diagnosis time: is defined as the time interval between the date of onset of symptoms and the date of the first medical consultation (admission date). System diagnosis time is the time interval between the date of the first medical consultation and the date of diagnosis (date of delivery of results). Vaccine efficacy was calculated as follows: (1 − OR) × 100 (%). The odds ratio was first calculated as a crude OR using a 2 × 2 contingency table comparing vaccination status between ELISA-positive cases and ELISA-negative controls through univariable logistic regression (liberal significance threshold of $p \leq 0.20$). In the multivariable logistic regression analysis (liberal significance threshold of $p \leq 0.05$), adjustments were made for age, year, and season; therefore, the reported OR reflects these adjustments and was used to estimate vaccine effectiveness.

2.7. Ethical and Regulatory Considerations

We obtained authorisation to access the data from the Secretary General (SG) of the Ministry of Health and Public Hygiene (MSHP). The confidentiality of the data was respected.

3. Results

3.1. Demographic Characteristics of Participants

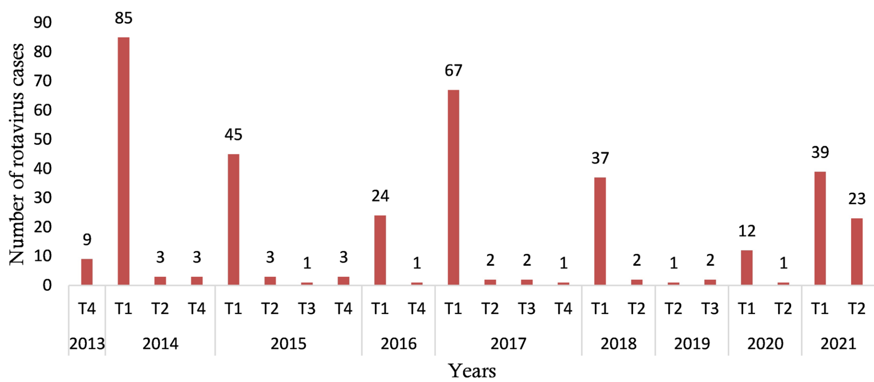
A total of 2135 suspected cases of infection in rotavirus children aged 0 - 59 months were reported. The most common age group was children aged 0 - 11 months, accounting for 44.96% of cases. Children aged 12 - 23 months and 24 - 59 months represented 39.11% and 15.93% respectively. Males represented 55.50%, with a sex ratio of 1.56 males to females.

3.2. Prevalence of Rotaviruses

Among the 2135 suspected cases included in the study, 784 (36.7%) did not undergo ELISA testing and were therefore excluded from the prevalence analysis because laboratory confirmation of rotavirus infection was unavailable. The prevalence analysis was consequently performed on the remaining 1351 children, among whom 366 tested positive, yielding a rotavirus prevalence of 27.10%.

3.3. Case of Rotavirus Infection by Year

The first quarter of each year from 2014-2022 constitutes the peak periods, except in 2019 when no positive cases were reported in the first quarter. The year 2014 had the highest number of positive cases with a total of 85 cases in the first quarter. Figure 1 shows the distribution of confirmed cases by year and by quarter.



Legend: T = Quarter.

Figure 1. Distribution of confirmed rotavirus cases by quarter and by year at the Gaoua CHR, 2013-2022.

3.4. Characteristics of Rotavirus Diarrhoea Cases

In our study, the most affected age group was children aged 0 - 11 months, with a proportion of 48.09%, followed by those aged 12 - 23 months, which was 44.81%. The male gender represented 60.93%.

3.5. Diagnosis and Hospitalization Times for Cases of Rotavirus Diarrhoea

The average time for diagnosis in the health system is the longest, at 27 days. This large difference between the mean (27 days) and the median (5 days) reflects a highly right-skewed distribution of diagnostic delays. Most patients were diagnosed within a few days, but a small number of cases experienced prolonged delays, which increased the mean (Table 1).

Table 1. Distribution of deadlines.

Variable	Average	Minimum	Maximum	Median
Patient diagnosis time (days)	3	0	10	3
Health system diagnostic time (days)	27	0	664	5
Hospitalization time (days)	4	0	18	4

Health system performance indicators for suspected cases

The test rate completion was the lowest indicator at 63.23%, according to Table 2.

Table 2. Performance indicators of the rotavirus surveillance system in the CHRG, Burkina Faso, 2013-2022.

Variables	Staff	Proportions (%)
Rate of samples collected	2098	98.26
One-dose vaccination coverage	1711	80.14
Photocopied heath record	1759	82.38
Percentage of tests performed	1351	63.27

Health system performance indicators for suspected cases from 2013 to 2022: vaccination coverage, ELISA test completion rate

No ELISA tests were performed in 2022. Vaccination coverage was higher at 93% (see Figure 2).

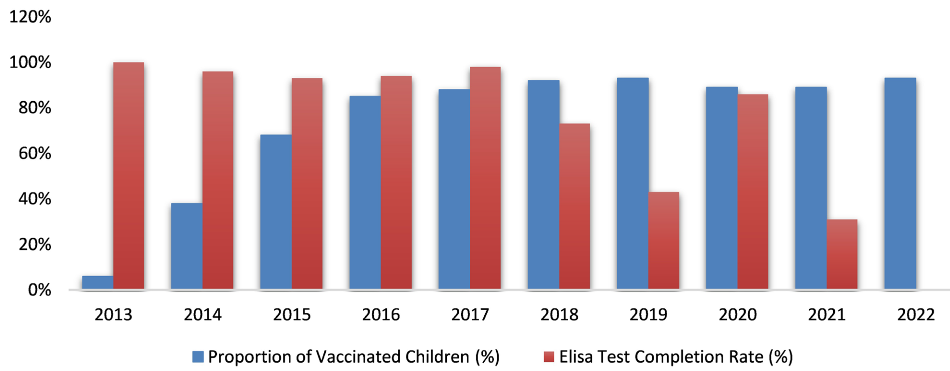


Figure 2. Distribution of children vaccinated and the number of tests performed in the CHRG per year, from 2013-2022.

3.6. Impact of Vaccination

Vaccination coverage among subjects with rotavirus diarrhoea with at least one dose of vaccine was 68.58%.

In our study, vaccinated children without rotavirus diarrhoea were the most represented group, with 761 subjects. The adjusted odds ratio (ORa), controlling for age, year, and season, was 0.644, CI [0.469 - 0.884], p = 0.0065, representing a vaccine efficacy of 36%. See Table 3.

Table 3. Vaccine efficacy (VE) against rotavirus diseases.

Vaccination status	Case		Control		HRa	p-value	VE (%)	95% CI
	n	%	n	%				
Not vaccinated	115	31	224	23	1		-	-
Vaccinated (≥1 dose)	251	69	761	77	0.644	0.0065	36	[12 - 53]

4. Discussion

Prevalence

The prevalence of rotavirus infection in our series was 27.10%. It is similar to that of Parvathi Durga *et al.* in India, 27% [11]. Our prevalence was higher than that by Ahmed Mohamed Fidhow *et al.* in 2017 in Kenya, Doutchi Mahamadou *et al.* in 2019 in Niger, Noshen Basharat *et al.* in 2021 in Pakistan, and Anil Kumar Goel *et al.* in 2021 in India respectively 17%; 21.43%; 22%; 11.02% [12]-[15]. This similarity and these discrepancies with other studies could be explained by the confirmation test used, which was the ELISA test in our study and PCR in others. In Burkina Faso, rotavirus infection remains one of the main causes of acute diarrhoea in children.

Time for diagnosis in the health system

The average time for diagnosis in the health system is the longest, and the large difference between the mean and the median reflects a highly right-skewed distribution of diagnostic delays. Most patients were diagnosed within a few days, but a small number of cases experienced prolonged delays, which increased the mean. Based on surveillance data, tests are performed according to the availability of reagents, which may sometimes be out of stock. In 2022, no tests could be performed because the reference laboratory no longer had diagnostic reagents available. The availability of supplies, or even of rotavirus diagnostic tests, could improve the long diagnostic delay and even patient management.

Health system performance indicator: vaccination coverage

In our study, 68.58% of children with confirmed rotavirus infection had received at least one dose of vaccine, compared with 80.14% among suspected cases. Doutchi Mahamadou *et al.* in Niger in 2019 reported 71.43% [13]. This proportion of vaccinated children remains lower than the target rate assigned by the Directorate of Vaccination Prevention in Burkina Faso and those achieved between 2013-2022. Nevertheless, the vaccination coverage in our series concerns confirmed cases and may underestimate the rotavirus vaccination coverage in the de Gaoua region. It follows from these results that rotavirus cases have low vaccination coverage.

Impact of vaccination

The preventive fraction or vaccine efficacy was 36% in our series. Aisleen Bennett *et al.* in Malawi in 2021 reported results almost similar to ours, 39% [16]. Results that are relatively higher than ours were reported than ours by Murunga *et al.* in 2020, Wang *et al.* in 2021, Erdem Gönüllü *et al.* in 2021 respectively of 61%, 84%, 75.1% [8] [17] [18]. These different results confirm the fact that vaccination against rotavirus has a protective effect against rotavirus infection. This discordance between these results could be explained by the type of vaccine used, the change of vaccine type during the year 2020, vaccination schedule adopted by the country, and the immune response of vaccinated individuals. However, vaccination is an effective strategy that must be optimized.

Study Limitations

The authors acknowledge several limitations of the study.

First, the single-center design limits the generalizability of the results due to limited external validity. Indeed, there are four sentinel sites for rotavirus surveillance in the country. Given that local practices and/or patient profiles differ from one region to another, selection bias may have arisen.

Furthermore, the absence of laboratory results for more than a third of suspected cases may have impacted reliability and validity. This could weaken the strength of the conclusions and limit the scientific scope of the research. To minimize this impact, some analyses, such as prevalence estimation, excluded these unconfirmed cases. However, this may have introduced measurement bias by underestimating or overestimating the prevalence of rotavirus.

In addition, our study, which used surveillance data, may have limitations related to incomplete records, measurement inaccuracies, and selection bias. Indeed, some suspected cases did not undergo biological confirmation, which may have reduced the statistical power of the tests and decreased the representativeness of the sample.

Finally, the cross-sectional nature of the study does not allow us to conclude a causal relationship due to the lack of temporal data, the risk of reverse causality, and the presence of probable confounding factors that could not be controlled.

However, we acknowledge the study's strength in being the first to not only determine the prevalence of rotavirus and describe its epidemiological profile, but also to evaluate the impact of vaccination and determine the performance indicators of its surveillance system.

5. Conclusion

The prevalence of rotavirus remains high at the Gaoua Regional Hospital Centre with children aged 0 - 11 months being the most affected age group. The first trimester of the year was the peak period corresponding to the dry season. Males were the most affected. Vaccination coverage was low among confirmed cases. Furthermore, although this vaccination is initiated in Burkina Faso at 2 months of age as part of the Expanded Program on Immunization (EPI), children aged 0 to 11 months remain the most affected. Cohort studies could examine the effect of the timing of vaccine introduction on rotavirus prevention in children under 5 years of age.

Acknowledgements

We would like to express our sincere thanks to the REDISSE project for its financial and technical support, particularly for funding the BFELTP training program, the BFELTP for its technical support, as well as the Directorate of Vaccination Prevention for providing data.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Crawford, S.E., Ramani, S., Tate, J.E., Parashar, U.D., Svensson, L., Hagbom, M., *et*

al. (2017) Rotavirus Infection. *Nature Reviews Disease Primers*, **3**, 1-16. https://doi.org/10.1038/nrdp.2017.83

[2] Mahamba, D., Hokororo, A., Mashuda, F., Msanga, D.R., Bendera, E.C., Kwiyolecha, E.N., *et al.* (2020) Prevalence and Factors Associated with Rotavirus Infection among Vaccinated Children Hospitalized for Acute Diarrhea in Mwanza City, Tanzania: A Cross Sectional Study. *Open Journal of Pediatrics*, **10**, 392-403. https://doi.org/10.4236/ojped.2020.103040

[3] Ai, C., Steele, M. and Lopman, B. (2020) Disease Burden and Seasonal Impact of Improving Rotavirus Vaccine Coverage in the United States: A Modeling Study. *PLOS ONE*, **15**, e0228942. https://doi.org/10.1371/journal.pone.0228942

[4] CDC (2021) Rotavirus in the U.S. Centers for Disease Control and Prevention. https://www.cdc.gov/rotavirus/surveillance.html

[5] OMS (2021) Vaccins antirotavirus: Note de synthèse de l'OMS—Juillet 2021.

[6] Asnakew, D.T., Teklu, M.G. and Woreta, S.A. (2017) Prevalence of Diarrhea among Under-Five Children in Health Extension Model Households in Bahir Dar Zuria District, North-Western Ethiopia. *Edorium Journal of Public Health*, **4**, 1-9. https://doi.org/10.5348/P16-2017-9-OA-1

[7] Burns, H.E., Collins, A.M., Fallon, U.B., Marsden, P.V. and Ni Shuilleabhain, C.M. (2020) Rotavirus Vaccination Impact, Ireland, Implications for Vaccine Confidence and Screening. *European Journal of Public Health*, **30**, 281-285. https://doi.org/10.1093/eurpub/ckz238

[8] Murunga, N., Otieno, P.G., Maia, M. and Agoti, N.C. (2020) Effectiveness of Rotarix® Vaccine in Africa in the First Decade of Progressive Introduction, 2009-2019: Systematic Review and Meta-Analysis. *Wellcome Open Research*, **5**, Article No. 187. https://doi.org/10.12688/wellcomeopenres.16174.2

[9] Operario, D.J., Platts-Mills, J.A., Nadan, S., Page, N., Seheri, M., Mphahlele, J., *et al.* (2017) Etiology of Severe Acute Watery Diarrhea in Children in the Global Rotavirus Surveillance Network Using Quantitative Polymerase Chain Reaction. *The Journal of Infectious Diseases*, **216**, 220-227.

[10] Kaboré, A., Zagré, A., Kam, M., Drabo, D., Ouédraogo, R. and Yé, D. (2017) Incidence des diarrhées à rotavirus chez les enfants de 0 à 5 ans hospitalisés à Ouagadougou (Burkina Faso). *Journal de Pédiatrie et de Puériculture*, **30**, 56-62. https://doi.org/10.1016/j.jpp.2016.11.004

[11] Durga, P., Ramanathan, D.R. and Ramamoorthy, D.R. (2020) Prevalence and Severity of Rotavirus Infection in Children Vaccinated against Rotavirus in a Tertiary Care Hospital, Chidambaram. *International Journal of Paediatrics and Geriatrics*, **3**, 76-79. https://doi.org/10.33545/26643685.2020.v3.i2b.98

[12] Fidhow, A.M., Samwel, A., Ng'ang'a, Z., Oundo, J., Nyangao, J. and Wences, A. (2017) Molecular Epidemiology and Associated Risk Factors of Rotavirus Infection among Children under 5 Years Hospitalized for Acute Gastroenteritis in North Eastern, Kenya, 2012. *Pan African Medical Journal*, **28**, Article No. 3. https://doi.org/10.11604/pamj.supp.2017.28.1.2486

[13] Mahamadou, D., Ibrahim, A.S., Inkov, I., Harouna, A., Issaka, M. and Kayryakova, M. (2019) Gastro entérites à rota virus chez les enfants de 0 à 59 mois à l'hôpital national de Niamey. *International Journal of Medical Reviews and Case Reports*, **3**, 558-564. https://doi.org/10.5455/ijmrcr.rotavirus-gastroenteritis

[14] Basharat, N., Sadiq, A., Dawood, M., Ali, S., Khan, A., Ullah, R., *et al.* (2021) Rotavirus Gastroenteritis in Pakistan, 2018: Updated Disease Burden. *BMC Infectious Diseases*, **21**, Article No. 426. https://doi.org/10.1186/s12879-021-06123-6

[15] Goel, A.K., Chawla, S., Dhingra, A., Thiyagarajan, V. and Nair, N.P. (2021) Rotavirus Diarrhea and Its Determinants among Under-Five Children Admitted in a Tertiary Care Hospital of Southern Haryana, India. *The Indian Journal of Pediatrics*, **88**, 16-21. https://doi.org/10.1007/s12098-020-03616-1

[16] Bennett, A., Pollock, L., Bar-Zeev, N., Lewnard, J.A., Jere, K.C., Lopman, B., *et al*. (2021) Community Transmission of Rotavirus Infection in a Vaccinated Population in Blantyre, Malawi: A Prospective Household Cohort Study. *The Lancet Infectious Diseases*, **21**, 731-740. https://doi.org/10.1016/s1473-3099(20)30597-1

[17] Wang, Y., Li, J., Dai, P., Liu, P. and Zhu, F. (2021) Effectiveness of the Oral Human Attenuated Pentavalent Rotavirus Vaccine (RotaTeqTM) Postlicensure: A Meta-Analysis—2006-2020. *Expert Review of Vaccines*, **20**, 437-448. https://doi.org/10.1080/14760584.2021.1902808

[18] Gönüllü, E., Soysal, A., Yıldız, İ. and Karaböcüoğlu, M. (2020) Impact of Self-Financed Rotavirus Vaccination on Acute Gastroenteritis in Young Children in Turkey. *Human Vaccines & Immunotherapeutics*, **17**, 510-516. https://doi.org/10.1080/21645515.2020.1776043