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# Prevalence of Rotavirus at Kenyatta National Hospital among children under 5 years of age presenting with gastroenteritis

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**Abstract**
**Introduction**: *Diarrhea has been one of the principal causes of death and the major cause of diarrhea is rotavirus. The global mortality caused by rotavirus is 453,000 annually and 80% of these deaths occur in developing countries. The effective way to control rotavirus is through vaccination. Two vaccines have been licensed for use which is; Rotateq and Rotarix. The Rota Teq vaccine was introduced in Kenya July 2014.*
**Objective**: *Determine the prevalence of RVA after the introduction of the vaccine. Samples were collected from children below 5 years of age presenting gastroenteritis whose parents consented to be in the study.*
**Method**: *The samples were collected from children below 5 years with gastroenteritis and analyzes by ELISA using prospect kit. Data were analyzed by chi-square and prevalence calculated in proportions.*
**Results**: *The prevalence of RVA was 14% as compared in previous studies which were 27%. The chi-square calculation showed no difference of RVA infection in regard to gender, inpatient, and outpatient. The most affected age group was between 7 to 12 months, followed by 13 to 24 months.*
**Conclusion**: *There is a decrease in rotavirus prevalence and vaccination campaigns need to be emphasized to decrease the prevalence further.*
**Keywords:** *Rotavirus, Kenya, Vaccine ELISA.*

## Introduction

The principal causes of death among children below 5 years of age in Kenya is diarrhea, which is estimated at 9% and about 27% of under-five diarrhea hospitalization is caused by rotavirus (Liu et al., 2012; Khagayi et al., 2014). Rotavirus has been associated with acute severe diarrhea among children under five years and the major cause of mortality in low and middle-income countries in Asia and sub-Saharan Africa (Fischer et al., 2000; Parashar et al., 2006). The global mortality rate caused by rotavirus group A is estimated at 453,000 annually (Tate et al., 2012). The approximation of 85% of the deaths occurs in Africa and Asia (Parashar et al., 2006). The estimates of deaths caused by rotavirus group A in Kenya include; 68 deaths, 132 hospitalization and 21800 clinic visits per 100,000 children below 5

years old (Nyangao et al., 2010). Rotavirus affects mostly children who age from 6 to 24 months (Cunliffe et al., 1998; Gatheru et al 1993). Studies carried in sub-Sahara Africa in Kenya, Tunisia and Nigeria indicate that 90% of children get infected with rotavirus by the time they reach 2 years (Aminu et al., 2010; Trabelsi et al., 2000; Nyangao.,2010).The classification of rotavirus is a double-stranded segmented RNA (dsRNA) virus which has three concentric layers of proteins. The most effective way of control rotavirus is a safe rotavirus vaccine which will reduce the mortality rates (Rodrigo et al., 2010). There are two rotavirus group A vaccine available; a pentavalent bovine-human reassortant (Rota Teq$^{TM}$) and a monovalent attenuated human (HuRVA) vaccine Rotarix$^{TM}$ which are recommended by world health organization (WHO, 2006). The vaccines have been introduced to the 81 countries as part of their national immunization program as of May 2006. The monovalent vaccine was introduced in Kenya to the national immunization program in July 2014 (Ernest et al., 2017).

The main purpose of the study was to determine the prevalence of rotavirus after the introduction of the vaccine among children with gastroenteritis attending Kenyatta National Hospital.

## Materials and Methods

### Sample collection

### Study site.

The study was carried at Kenyatta national hospital, located in Nairobi County in Kenya. It is the largest referral hospital in Kenya.

### Study Population

The study involved children below 5 years of age presenting with gastroenteritis at Kenyatta national hospital.

### Inclusion and exclusion criteria

The children who were included in the study were those whose parents or guardians consented. They were below 5 years of age and presented with acute diarrhea for not more than 7 days and had experienced three episodes of watery stools in 24 hours.

### Sampling

The sampling method which was used was random and consecutive until the required sample size was reached.

A total of 355fecal samples were collected in the year 2017 from children under the age of 5 years presenting with gastroenteritis who visited Kenyatta National Hospital.

The study was approved by Kenyatta and University of Nairobi Ethical Review board.

### Laboratory Method

The Enzyme Immunoassay was used for detection of RVA which was a rapid and sensitive method which has been used since the 1980s (Dennehy *et al*., 1988; Christy *et al*., 1990). The commercial kit which was used was ProSpect$^{TM}$

### Rotavirus detection

The preparation of fecal suspension was prepared by suspending 1g of stool sample 0r 100ul rectal swap to 1ml of 0.01M phosphate- buffered saline (PBS). The suspension was vortexed vigorously and centrifuged at 10,000 rpm at 5 minutes. The suspension was tested for RVA antigen by ELISA (Taniguchi et al., 1987) using PROSPECT kit.

## Results

A total number of samples collected were 355 from children presenting with gastroenteritis and which met the WHO rotavirus criteria (WHO 2002). The prevalence of rotavirus was 14.36 % (51/355). RVA distribution among gender 33/51 males was positive as compared to 18/51 female who were positive. The distribution of rotavirus group A between outpatient and inpatient showed that 27/51 were inpatient and 24/51 were outpatient. When the distribution was analyzed by chi-square to show the difference in prevalence in regard to gender, inpatient, and outpatient. The distribution showed no difference at 95 confidence interval since $p< .05$. The chi-square statistic was 0.6980 and P value was 0.873472. The results are shown in table 2. The presentation of gastroenteritis in regard to age showed that 7 to 12 months were mostly affected followed by 13 to 24 months. The least affected were from 0 to 3

months. This can be attributed to maternal antibodies. The demographic distribution of the children showed that most children came from Nairobi County and a few came from neighboring counties Like Kiambu, Kajiado, and Machakos. The presentation is presented in figure 1.

**Table 1:** Elisa Results

| | Rotavirus Positive Cases | Gastroenteritis Cases | Total | % positive |
|---|---|---|---|---|
| Female | 18 | 113 | 131 | 13.74 |
| Male | 33 | 191 | 224 | 14.73 |
| Total | 51 | 304 | 355 | 14.37 |
| | | | | |
| Inpatients | 27 | 179 | 206 | 13.11 |
| Outpatients | 24 | 125 | 149 | 16.11 |
| Totals | 51 | 304 | 355 | 14.37 |

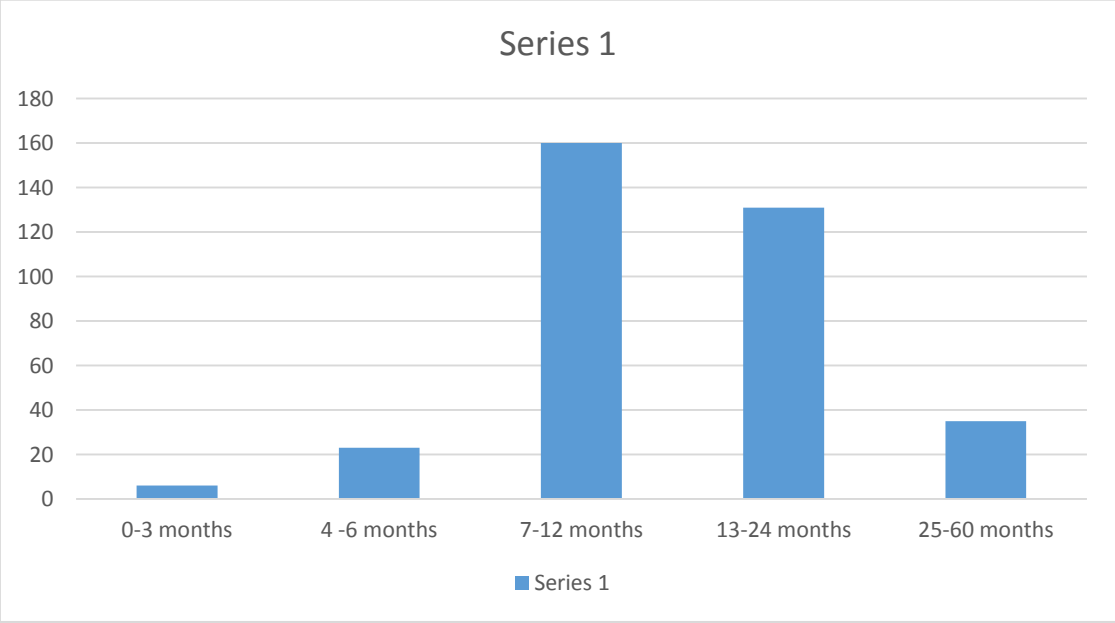
**Table 2:** Chi-square Results

The factors associated with rotavirus infection were analyzed with chi-square in the table below. The findings showed no difference in regard to age and gender.

| **Results** | | | |
|---|---|---|---|
| | Positive | Negative | **Row Totals** |
| Male | 33 (32.18) [0.02] | 191 (191.82) [0.00] | 224 |
| female | 18 (18.82) [0.04] | 113 (112.18) [0.01] | 131 |
| Inpatient | 27 (29.59) [0.23] | 179 (176.41) [0.04] | 206 |
| Outpatient | 24 (21.41) [0.31] | 125 (127.59) [0.05] | 149 |
| | | | |
| **Column Totals** | 102 | 608 | |

The Chi-square statistic is 0.6989. The P-value is 0.873474. The result is not significant at $p<0.05$.

**Figure 1:** Distribution of gastroenteritis among children according to age groups.




**Discussion**

The principal objective of the study was to establish the prevalence of RVA among children below the age of 5 years who present with gastroenteritis at Kenyatta National Hospital after the introduction of the vaccine in July 2014 (Wandera et al., 2017). The study showed that RVA prevalence was at 14% among children below 5 years who presented gastroenteritis at Kenyatta National Hospital. The prevalence

shows a decrease in prevalence as compared with studies done in different regions in the earlier years which showed an average prevalence of 27% (Wandera. et al 2017; Nokes., et al 2011; Agutu et al 2017). The review article conducted between 1975 to 2005 on the prevalence of rotavirus in Kenya indicated that the prevalence ranges between 11 to 56 % (Kiulia et al., 2008), while a study carried at Kenyatta national hospital indicated the prevalence to be 56% (Gatinu et al., 2007). The studies carried in other parts of the country like Kiambu County showed the prevalence to be 36. 6% (Apondi et al., 2012). The chi-square analysis showed no difference in distribution among gender and inpatient or outpatient. The gender factor and infection rate agrees with another study finding which looked at risk factor and diarrhea among children (Pennal et al., 2010). The gastroenteritis distribution occurred among all age groups (0 to 59 months) the most affected age group is 7 to 12 months while the least affected being 0 to 3 months. These findings agree with other studies carried out in the country and WHO surveillance team (Wandera et al., 2017; WHO 2012). At the age of 5 months the maternal antibodies which protect the child from rotavirus decline and makes the child vulnerable to infection (Odiit et al., 2014).Research indicated that the most affected children were below 18 months and vaccination will not benefit children above 24 months since they have developed antibodies against rotavirus due to exposure to rotavirus (Wandera et al., 2017; WHO 2012). The main objective of rotavirus vaccination was to prevent infection by inducing immunity before the natural infection occur (Wandera et al., 2017). The vaccination has reduced the prevalence from 27% studies carried before to 14 %. The vaccination campaign should be emphasized and more children vaccinated. Although the Rotarix vaccine protects against GIP[8] that was the most prevalent genotype. This indicates more has to be done for to increase the number of kids get the vaccine and they should get all the vaccine doses. Close monitoring of the vaccination program, the impact of the vaccine and the molecular epidemiology has to done continually to help in public health programs.

**Conclusions**

The prevalence of Rotavirus was 14% after vaccine introduction.

**Acknowledgement**

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