

BRIEF REPORT

Epidemiology of Rotavirus Infection in Children from a Rural and Urban Area, in Maputo, Southern Mozambique, before Vaccine Introduction

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ABSTRACT

This study aimed to describe the epidemiology of rotavirus infections in Mozambique before vaccine introduction. Between February 2012 and September 2013, stool specimens, demographic and clinical data were collected from 384 children <5 years old hospitalized with acute diarrhea in Mavalane General Hospital and Manhiça District Hospital, southern Mozambique. The samples were tested for rotavirus A using enzyme-linked immunosorbent assay. The overall prevalence of rotavirus infection was 42.4% [95% confidence interval (95CI): 37.4–47.6%], and was similar in Manhiça (44.3%; 95CI: 36.2–52.7%) and Mavalane (41.3%; 95CI: 34.9–47.9%). The highest prevalence of rotavirus infection was observed in children between 6 and 11 months old. It was also observed that 162 (43.7%) of the children were underweight (weight-for-age z-score < -2), of which 61 were infected by rotavirus.

KEYWORDS: rotavirus, children, diarrhea, hospitalization, epidemiology, Mozambique.

BACKGROUND

Rotavirus is the major cause of acute gastroenteritis in children worldwide, causing an estimated 215 000 (range, 197 000–233 000) deaths annually in infants and children <5 years of age [1].

Mozambique introduced the rotavirus vaccine (RV1; Rotarix® GSK Biologicals, Rixensart, Belgium) in the National Immunization Program in September 2015. Thus, knowledge of rotavirus epidemiology infection before the vaccine introduction will provide

baseline information to evaluate the vaccine impact in the near future. The objectives of the present study were to describe the epidemiology of rotavirus disease in children <5 years old hospitalized with acute gastroenteritis in Manhiça (a rural area) and Mavalane (an urban area) before RV introduction.

METHODS

A cross-sectional study was performed in Mavalane General Hospital (MGH) and Manhiça District Hospital (MDH), located in Maputo, southern Mozambique. The study started in February 2012 at MDH and in April 2012 at MGH and lasted until September 2013. MDH is a referral hospital located in a rural area, admitting about 4500 children yearly, and the full description of study site and population has been described elsewhere [2]. MGH is a referral hospital located in an urban area of Maputo, attending approximately 6000 children per month in their emergency department.

Children <5 years old hospitalized with acute diarrhea, defined by three or more loose stools in the last 24 h in the 7 days before medical visit, were included. Written informed consent was obtained from the children's guardian and then an epidemiological questionnaire was administered.

A total of 409 stool and dried blood spot samples were collected. Twenty-five cases were excluded from the analysis owing to the lack of demographic or clinical information. A sample size of 384 children was used for the statistical analysis.

The samples were transported to the laboratory of Manhiça Health Research Centre for processing. Ten percent suspensions of the stool specimens were made in phosphate buffered saline and the dilutions screened with a commercial enzyme-linked immunosorbent assay (ProSpect™ Rotavirus, Oxoid, Ely, United Kingdom) according to the manufacturer's instructions. Infants were tested for HIV-1 using dry blood spot with the Amplicor DNAPCR kit (Roche Diagnostics, Basel, Switzerland).

The data were analyzed with Stata version 14 (College Station, TX: StataCorp 2015 LP). As a measure of association between demographic and clinical characteristics and rotavirus presence, prevalence ratios (PRs) [and their 95% confidence interval (95CI)] were computed through Poisson regression,

with robust standard errors as an alternative to log-binomial regression under non-convergence [3]. Weight-for-age z-scores (WAZ) were calculated using the World Health Organization reference curves [4]. A child with WAZ < -2 was considered underweight.

The protocol was approved by the Mozambican National Bioethics Committee for Health in 2010 (IRB 00002657).

RESULTS

From the 384 children, 235 were from Mavalane (61.2%) and 149 from Manhiça (38.8%), as shown in Table 1. The overall prevalence of rotavirus infection was 42.4% (95CI: 37.4–47.6%). Similar prevalence was observed in Manhiça (44.3%) and Mavalane (41.3%). Among the 163 children positive for rotavirus, 91 (55.8%) were males and 72 females (44.2%). The median age among rotavirus-infected children was 10 months [interquartile range (IQR): 6.8–13.9], slightly lower compared with uninfected children (11.5 months, IQR: 8.3–17.0). More than 60% of the cases were infants, with the highest prevalence of infection (42.9%) being observed in children aged 6 and 11 months (Table 1).

Nausea and vomiting were the most frequent [72.4% (118 of 235)] symptoms among rotavirus-infected children compared with 52.9% (117 of 221) among children without rotavirus. Children with nausea and vomiting had 1.66 (95CI: 1.26–2.19) folds higher rotavirus positivity compared with those without nausea and vomiting. Children with rotavirus infection [35% (69 of 147)] were more protected to fever compared to those without the infection [50.3% (94 of 187)], (PR: 0.70; 95CI: 0.55–0.88); Table 1.

Sixty-eight children (17.7%) were infected with HIV and 20 (5.2%) coinfecting with HIV and rotavirus. High frequency of underweighted children was observed (43.7%, 162 of 384), among whom the rotavirus prevalence was 37.7% (61 of 162).

Of the 163 cases of rotavirus, 86.5% (141 of 163) occurred in the cooler, dry season (April–September) and 13.5% (22 of 163) in the wet season (October–March), corresponding to an associated increase in prevalence of 2.88 (95CI: 1.94–4.27) times. During the dry season, the peaks of detection were observed

Table 1. Socio-demographic and clinical characteristics of children under 5 years-old rotavirus positive and negative, in Mavalane and Manhiça, Mozambique, 2012–2013

Characteristic	Total		Rotavirus negative		Rotavirus positive			Unadjusted		
	N	%	N	%	N	%	Prevalence (95CI) in %	PR	95CI	<i>p</i>
Total recruited	384		221		163		42.4 (37.4–47.6)			
Site										
Mavalane	235	61.2	138	62.4	97	59.5	41.3 (34.9–47.9)	1.00	–	0.558
Manhiça	149	38.8	83	37.6	66	40.5	44.3 (36.2–52.7)	1.07	0.85–1.36	
Gender										
Male	213	55.5	122	55.2	91	55.8	42.7 (36.0–49.7)	1.00	–	0.903
Female	171	44.5	99	44.8	72	44.2	42.1 (34.6–49.9)	0.99	0.78–1.25	
Age (months)										
Median (IQR)	10.9 (7.6–15.6)		11.5 (8.3–17.0)		10.0 (6.8–13.9)		–			0.008
0–5	61	15.9	30	13.6	31	19.0	50.8 (37.7–63.9)	1.00	–	0.145
6–11	157	40.9	87	39.4	70	42.9	44.6 (36.7–52.7)	0.88	0.65–1.19	
12–23	131	34.1	78	35.3	53	32.5	40.5 (32.0–49.4)	0.80	0.58–1.10	
24–59	131	9.1	26	11.8	9	5.5	25.7 (12.5–43.3)	0.51	0.27–0.94	
Seasonality										
Wet	119	31.0	97	43.9	22	13.5	18.5 (12.0–26.6)	1.00	–	<0.001
Dry	265	69.0	124	56.1	141	86.5	53.2 (47.0–59.3)	2.88	1.94–4.27	
Had fever										
Yes	197	51.3	128	57.9	69	42.3	35.0 (28.4–42.1)	0.70	0.55–0.88	0.003
No	187	48.7	93	42.1	94	57.7	50.3 (42.9–57.6)	1.00	–	
Missing	16	4.2	9	4.1	7	4.3	43.8 (19.8–70.1)			
Had nausea or vomiting										
No	149	38.8	104	47.1	45	27.6	30.2 (23.0–38.3)	1.00	–	<0.001
Yes	235	61.2	117	52.9	118	72.4	50.2 (43.6–56.8)	1.66	1.26–2.19	
Child HIV status										
Positive	68	17.7	48	21.7	20	12.3	29.4 (19.0–41.7)	0.67	0.45–0.99	0.044
Negative	279	72.7	157	71.0	122	74.8	43.7 (37.8–49.8)	1.00	–	
Probably exposed	8	2.1	4	1.8	4	2.5	50.0 (15.7–84.3)	1.34	0.96–1.87	
Unknown or missing	29	7.6	12	5.4	17	10.4	58.6 (39.0–76.5)	1.14	0.56–2.32	
Nutritional status										
WAZ < –2	162	43.7	101	47.0	61	39.1	37.7 (30.2–45.6)	0.83	0.65–1.06	0.137
WAZ ≥ –2	209	65.1	114	62.0	95	69.3	45.5 (38.6–52.5)	1.00	–	
Missing	13	4.0	6	3.3	7	5.1	53.8 (25.1–80.8)	–	–	

in July and August where the proportion of positive samples ranged from 69 to 74% (Fig. 1).

DISCUSSION

The overall prevalence reported here (42.4%) was high compared with other studies (24%) from Chókwè District, also in southern Mozambique [5].

This difference can be explained by the fact that in the Chókwè study, 87% of the children were recruited as outpatients, while this study was conducted primarily among hospitalized children. The prevalence reported in our study is also high if compared with those reported from other African countries such as Malawi [6], Namibia [7] and South

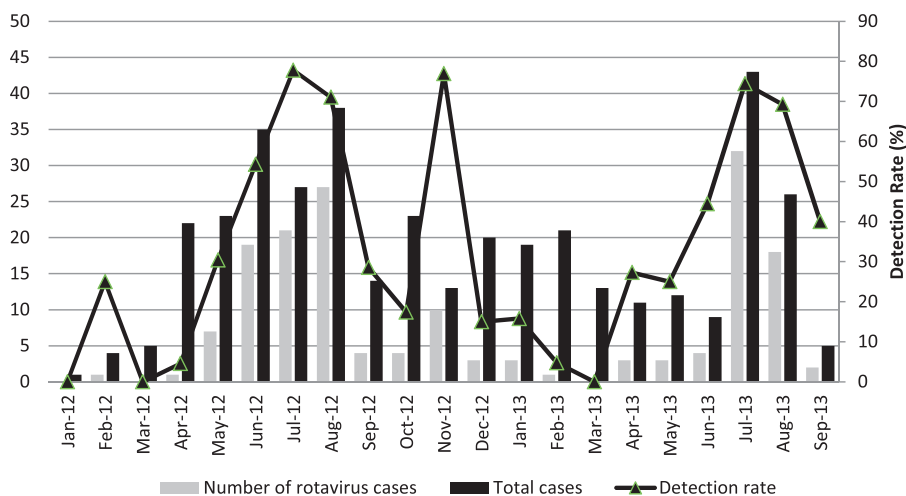


Fig 1. Number of diarrhea, rotavirus cases and proportion of RV positive in the two sites from January 2012 to September 2013 of children under 5 year-old, Mozambique.

Africa [8], which detected rates ranging from 26.4 to 32.1% in hospitalized children.

More than 60% of the rotavirus cases occurred in children <1 year old and the median age was 10 months, slightly higher compared with a Malawian study, in which it was 7.8 months [6]. The infection was most frequent in children from 6 to 11 months of age. Similar results were reported in the same age group in Chókwe in Mozambique [5], Malawi and Burkina Faso [6, 9].

Rotavirus infection was associated with less fever and more nausea and vomiting presentations. Vomiting has been reported to be associated with rotavirus infection in other countries [10, 11], while in Burkina Faso, fever was observed as the most associated symptom [9].

Five percent of the children were coinfecting with rotavirus and HIV, but we did not find an association between child HIV infection and rotavirus presence, being consistent with several other studies [12, 13].

We observed a high proportion of underweight children although without a significant difference in rotavirus positive and negative groups, and this frequency cannot be neglected. Recently, in Botswana, a study reported a significantly higher RV1 vaccine effectiveness in children with no undernutrition compared with those with moderate or severe undernutrition [14].

We detected rotavirus throughout the year; however, the peak of infection was observed in dry and

cool seasons (April–September). Studies suggest that RVA infection is associated with low temperature and low relative humidity [15, 16].

The present study faced two limitations: difference between the hospitals in terms of patients' flow, and the data do not cover fully at least 2 years of surveillance, impairing the seasonality assessment.

In summary, this study shows that rotavirus occurs with high frequency in children <1 year of age in dry and cool seasons in Mozambique.

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