Trends of Diarrhoeal Cases and Mortality in under 5 Children in Ethiopia Pre and Post Vaccine Introduction (A 7 years Trend Analysis)

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Abstract: Background: Rotavirus is the most common cause of gastroenteritis in young children. Most children will experience at least one infection with rotavirus by the time they are five years old, with some requiring hospitalisation for dehydration with the highest incidence being in developing countries before the introduction of Rota virus vaccines which has been introduced into vaccination programme in Ethiopia since November 2013. Objective: This study assessed trends of diarrhoea cases (morbidity and mortality) in under 5years’ children in Ethiopia pre and post vaccine introduction. Methods: A retrospective population survey of all watery diarrhea cases (defined as 3 or more watery, non-bloody stools within 24 hours that has lasted for less than or =7 days) and mortality from national data (HMIS- health management information system) for the years 2011- 2013 and 2014-2017 was done. Results: There were 178,057 diarrhoeal cases, male, 118,922(66.8%) and female, 59,135(33.2%) in prevaccine era (2011-2013) with 22, 025(13.2%) diarrhoeal related deaths. In the post vaccine era(2014-2017) 59,788 diarrhoeal cases with males, 36,154 (60.5%) and females, 23,634 (39.5%) with deaths, 3,079 (5.1%). Conclusions: This study clearly demonstrated that there is significant reduction in diarrhoea prevalence, 178,057 VS 59,788(1.2% and 0.43%), diarrhoeal related mortality (13.2% VS 5.1 %) in Ethiopia.

Keywords: Rota vaccine, diarrhoeal prevalence, diarrhoeal related mortality

Abbreviations

• HMIS- health management information system
• NIPs-National Immunization Programs
• GAVI-Global Alliance for vaccines and immunization
• IRB-institutional review board

Operational definition

• Prevaccine era- before the introduction of Rota vaccine in Ethiopia
• Post vaccine era- After the introduction of Rota vaccine in Ethiopia
• Watery diarrhea- passage of 3 or more stools per day with no blood or mucoid in it.
• Seasonality- the months at which largest diarrhoeal cases have been registered on HMIS book.
• Not died- children with acute watery diarrhea registered on HMIS, treated and cured.

1. Introduction

Rotavirus is a leading cause of severe acute gastroenteritis in the world, and vaccination is considered the most effective intervention to reduce its occurrence (7,8) Before the introduction of rotavirus vaccines, almost all children experienced at least one episode of rotavirus gastroenteritis before the age of 5 years(9) and was estimated to cause 215,000 deaths and 2 million hospitalizations per year worldwide (10). After demonstrated studies of safety and efficacy among children and significant reduction of cases and severity, vaccines were adopted by the immunization schedules of different countries (11-13). Routine surveillance systems from North America and Europe have reported consistent evidence of Rotateq and Rotarix effectiveness through their routinely collected statistics (14.)

Rotavirus vaccination would be a highly cost-effective intervention. It was predicted to reduce deaths attributed to rotavirus diarrhea (15) lower-middle-income countries have introduced rotavirus vaccination in their National Immunization Programs (NIPs) as of June 2010-2013 including 10 GAVI-eligible countries: Armenia, Bolivia, Georgia, Ghana, Guyana, Honduras, Moldova, Nicaragua, Sudan, and Yemen (16, 17), Ethiopia introduced Rotarix vaccine since November, 2013. In clinical trials, the efficacy of rotavirus vaccines varies by the level of income, immunoresponses, concomitant enteric infections, oral polio vaccine interference and under nutrition (18-22).

This study determined the prevalence of diarrhoeal disease before and after rotavirus vaccine, assess temporal trend and age group distribution of acute gastroenteritis and identify proportion of diarrhoeal cases.

2. Materials and Method

All-causes of diarrhoeal cases, and data for children under 5 years in Ethiopia from 2011 to 2017 were reviewed. The
A letter was written from the department of pediatrics and college of health sciences ethical committee. Ethical clearance was obtained from department research ethical committee, Addis Ababa University medical faculty college of health sciences institutional review board (IRB). A letter was written from the department of pediatrics and child health to Ethiopian federal ministry of health to get permission for the HMIS data and agreement was signed.

3. Result

There were 178,057 diarrheal cases, male, 118,922 (66.8%) and female, 59,135 (33.2%) in prevaccine era (2011-2013) with 22,025 (13.2%) diarrheal related deaths, most deaths occurring in age groups <11months and most diarrheal episodes in infants age 9-12 months. Among the 178,057 diarrheal cases, 138,896(78%) were with some dehydration and 39,161(22%) were cases of severe dehydration. Great majority of the occurrences were in April-August. The prevalence of diarrheal disease in the general population, taking population mean of the risks or under fives is 178,057/15,349,673 = 1.2% before the vaccine and 59,788/13,769,874 = 0.43% after the vaccine (Table 1).

In the post vaccine era, there were a total of 59,788 diarrheal cases, male, 36,154 (60.5%) and females, 23,634 (39.5%). Regarding deaths, 3,079 (5.1%). Among the 59,788 diarrheal cases, some dehydration, 49,489 (82.3%) and severe dehydration, 10,299 (17.7%) (Table 1). Seasonality is the same with the pre vaccine episodes (Fig. 2).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre vaccination</th>
<th>Post vaccination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Frequency (N=178,057)</td>
<td>Percentage</td>
</tr>
<tr>
<td>Male</td>
<td>118,922</td>
<td>66.8</td>
</tr>
<tr>
<td>Female</td>
<td>59,135</td>
<td>33.2</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 – 3 Months</td>
<td>858,174</td>
<td>0.5</td>
</tr>
<tr>
<td>3 – 6 Months</td>
<td>24,264</td>
<td>9.8</td>
</tr>
<tr>
<td>6 – 9 Months</td>
<td>86,234</td>
<td>13.6</td>
</tr>
<tr>
<td>9 – 12 Months</td>
<td>49,228</td>
<td>48.4</td>
</tr>
<tr>
<td>&gt;12 Months</td>
<td></td>
<td>27.7</td>
</tr>
<tr>
<td>Degree of dehydration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some dehydration</td>
<td>138,896</td>
<td>78</td>
</tr>
<tr>
<td>Severe dehydration</td>
<td>39,161</td>
<td>22</td>
</tr>
<tr>
<td>Patient outcome</td>
<td>22,025</td>
<td>13.0</td>
</tr>
<tr>
<td>Death</td>
<td>156,032</td>
<td>87.0</td>
</tr>
<tr>
<td>Cured and discharged( Not died)</td>
<td>67,259</td>
<td>587,10</td>
</tr>
</tbody>
</table>

Figure 1: Prevalence of diarrhea during pre and post vaccination eras(2011-2017) in Ethiopia.
In developing countries, diarrhea is a major cause of disease among under-5-years, with an estimated 600,000 deaths each year. This study suggests majority of cases involving severe diarrhea is caused by rotavirus infection. Rotavirus vaccines have shown a potential to prevent more than 20% of all diarrhea-related hospitalizations in children. Vaccine has been proven to be one of the most significant interventions in reducing childhood mortality.

The prevalence of diarrheal disease in the general population, taking population mean of the risks or under-fives is 178,057/15,349,673 = 1.2% before the vaccine and 59,788/13,769,874 = 0.43% after the vaccine. As compared to the pre vaccine era, severity of diarrhea decreases by 4.3% in post vaccination era, and death due to diarrhea decreases by 8.1%.

According to the age group, high prevalence was observed in the age groups of 9-12 months as compared to other age groups. But it decreases markedly as compared to the pre vaccination era by 10%.

There is no difference in seasonality in pre and post vaccination eras, the prevalence was peak during winter (April, May and June) and starts to decline during summer. This may be associated with shortage of water supply that predisposes to poor sanitation and may aggravate the occurrence of diarrhea.
Prevalence of diarrhea, degree of severity and death rate decreases uniformly in post vaccination era in Ethiopia.

This retrospective survey clearly showed that there is almost 40% reduction in diarrheal deaths after the introduction of Rota vaccine in Ethiopia. The result is similar to studies done in different countries, Rural Kenya (21, July, 2010), Brazil (Sempt., 11, V, 16, pp 1180–1184) and April, 2011.) Mexico (Nov. 28, 2012) and many other countries.

In general, strong suggestive evidences on beneficiary effects of Rota virus vaccine against fatal deaths due to Rota dehydrating diarrhea is demonstrated in this study.

5. Conclusions

After the introduction of rotavirus vaccination for infants, significant reduction was observed in under-5-years diarrhea-related mortality and prevalence of diarrhea in Ethiopia.

The largest reductions in diarrhea-related mortality and prevalence for diarrhea were among children younger than 1 year, indicating that the reduced diarrhea burden in this age group was associated with introduction of the rotavirus vaccine (other factors which can contribute for the reduction of diarrhea in Ethiopia like personal and environmental sanitations, controlling other infections, preventing malnutrition etc, had been there even before the introduction of the Rotavirus vaccine but the diarrheal morbidity was higher before the introduction of the vaccine and declines after the vaccine).

These national data are consistent with evidences from other countries and strengthen the evidence base for the continuation of rotavirus vaccination as an effective measure for controlling severe and fatal childhood diarrhea.

6. Acknowledgement

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The author

8. Computing interest

None declared

References

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