The Impact of Rotavirus Disease in Venezuela

Irene Pérez-Schael

Information concerning the disease burden of rotavirus, particularly in developing countries, has important implications for the use and for monitoring the impact of rotavirus vaccines. Although rotavirus has been recognized as the most frequent cause of hospitalization in the world, national estimates and specific information about the incidence of hospitalization for rotavirus gastroenteritis are very limited. Consequently, estimates of the incidence of hospitalization among children during the first 2 years of life in Venezuela were determined by extrapolation of data from a community-based study carried out in Caracas.

Worldwide, rotavirus is the most important etiologic agent of severe gastroenteritis in children <5 years old [1]. The disease is universal, affecting 95% of children <5, regardless of socioeconomic status or environmental conditions [1]. However, the outcome and consequences of rotavirus illness in developed countries are very different from those in developing countries. Although the incidence of morbidity related to rotavirus disease in young children is similar in both types of countries [2, 3], the disease is more often severe and fatal in children in developing countries. Rotavirus disease is estimated to be responsible for the death of >870,000 children (1–4 years old) and for 17 million cases of moderate to severe diarrhea in developing areas each year [4], and in the United States, rotavirus causes 70,000 hospitalizations and 75–125 deaths annually in children <5 years old [5]. Therefore, a rotavirus vaccine would be useful in both developed and developing countries for prevention of severe disease and reduction of treatment costs.

The most advanced candidate rotavirus vaccine is a rhesus rotavirus (RRV) quadrivalent vaccine containing RRV-human reassortant viruses for serotypes 1, 2, and 4 and a RRV strain for serotype 3 [6]. Three doses of RRV quadrivalent vaccine (4 × 10⁶ pfu) gave 82% protection against severe rotavirus gastroenteritis in a study done in 23 centers in the United States [7].

The efficacy of the quadrivalent RRV vaccine in developing countries is uncertain: Information about efficacy varies and is inconclusive [2, 7]. However, results from a trial of the candidate vaccine, which is underway in Venezuela (to be completed in 1996), will be of critical importance for determining whether it can prevent severe illness in developing countries.

Before initiating and evaluating national vaccine programs, it is essential to know the impact and burden of rotavirus disease in the particular country being studied, especially in developing countries. However, specific information about the incidence of illness and hospitalization due to rotavirus illness in these countries is limited. This report provides estimates of the incidence of rotavirus disease, the distribution of disease severity, and the incidence of rotavirus gastroenteritis requiring hospitalization in Venezuela; the estimates were extrapolated from results of a community-based study done in Caracas [8].

Epidemiology of Rotavirus in Venezuela

In Venezuela, enteritis is the ninth most common cause of death (12.1/100,000 population); In 1992, 2449 deaths due to diarrheal disease were reported [9]. Gastroenteritis, the primary cause of transmissible disease in Venezuela [9], is responsible for 8%–14% of hospital consultations (unpublished data). In 1994, ~425,814 episodes of diarrhea, with various degrees of severity, were reported in children <5 years old; 228,345 of these episodes were diagnosed in children <1 year old [10].

In a community-based study, with household surveillance of diarrhea episodes, done in two marginal areas of Caracas, the rate of gastroenteritis illness was 2.2 episodes/child/year in the first 2 years of life (table 1) [8]. This incidence is lower than the median rate of 3.9 episodes/child/year that was estimated for children in Latin America [11] and similar to incidences in developed countries [2, 11].

Among the large number of viral, bacterial, and parasitic enteropathogens associated with gastroenteritis, rotavirus is the most frequent cause (30%–50%) for consultation and hospitalization for gastroenteritis in Venezuela [12–14]. In contrast, in the community-based study, rotavirus was diagnosed in only 9.9% of the cases of diarrhea (0.169 episode/child/year) [8]. This percentage is small but similar to that in other areas of the world [3, 11].

In addition, data from a 1-year study of 1041 children with diarrheal illness who attended two hospitals in north and southwest Caracas indicated that rotavirus was diagnosed in 27% of the outpatients and in 45% of the inpatients (unpublished data).
to evaluate the efficacy of the RRV vaccine in 1- to 10-month-old children who were followed for 1 year. Among 151 children in the first 2 years of life, 1 in 18,000 children are hospitalized with probable rotavirus gastroenteritis, and 1 in 50 will have an episode of dehydration each year. Although extrapolation of the community-based data to national estimates could be risky and limited, it is nevertheless useful for determining the incidence and the burden of rotavirus disease and the cost estimates in individual national settings.

In the United States, various studies have been done on the cost benefit, cost effectiveness, and economic impact of rotavirus immunization [5, 16, 17]. These studies have shown that the rotavirus vaccine is to be both cost effective and cost saving.

Similarly, Bern and Glass [11] reported that rotavirus was diagnosed in a median of 17% (range, 1.3%-34%) of the subjects in 14 outpatient studies and 24% (range, 14%-41%) of subjects in 11 inpatient studies. The difference between the number of cases of rotavirus identified in inpatients compared with outpatients with diarrhea suggests the relative importance of this microorganism in severe childhood disease in Venezuela and other regions of the world.

### Table 1. Results of a community-based study showing the incidence of rotavirus illness among 151 children (130 child-years of observation) <5 years old in Caracas, Venezuela.

<table>
<thead>
<tr>
<th>Diarrhea of rotavirus episode</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>290</td>
</tr>
<tr>
<td>Episodes/child/year</td>
<td>2.2</td>
</tr>
<tr>
<td>Rotavirus-positive diarrhea</td>
<td>22</td>
</tr>
<tr>
<td>Episodes/child/year</td>
<td>0.169</td>
</tr>
<tr>
<td>Hospitalizations</td>
<td>4</td>
</tr>
<tr>
<td>Hospitalization episodes/child/year</td>
<td>0.03</td>
</tr>
<tr>
<td>Episodes resulting in dehydration</td>
<td>3</td>
</tr>
<tr>
<td>Episodes with dehydration/child/year</td>
<td>0.02</td>
</tr>
</tbody>
</table>

NOTE. Adapted from Pérez-Schael et al. [8].

The results of a community-based study [8] were used to estimate national annual rates of rotavirus disease and to assess the impact of rotavirus in Venezuela. This study was conducted to evaluate the efficacy of the RRV vaccine in 1- to 10-month-old children who were followed for 1 year. Among 151 children from the placebo group (or 130 child-years of observation), there were four cases of rotavirus diarrhea requiring hospitalization, three of which were children presenting with dehydration (table 1).

To estimate the annual number of hospitalizations for rotavirus illness and dehydration for the total population of Venezuela, the number of children born each year (mean of the numbers from the previous 5 years) was multiplied by the incidence of hospitalization for rotavirus illness as determined in the community-based study in Caracas [8]. In that study, all children hospitalized with diarrhea or dehydration were examined for rotavirus infection.

Extrapolation of the community-based data to national data, on the basis of a cohort of 600,000 Venezuelan children born each year, permitted an estimation of hospitalization rates for rotavirus illness for the total population. The estimates indicated that in the first 2 years of life, ~18,000 children are hospitalized with probable rotavirus gastroenteritis every year, or for each 1000 children, 30 are hospitalized each year during the first 2 years of life. These estimates are 3.5 and 6.2 times higher than estimates for rotavirus disease in the United States (8.5 hospitalizations/1000 children/year) and Denmark (4.8 hospitalizations/1000 children/year), respectively [15].

No hospital and laboratory data were available to determine the relationship of rotavirus to mortality in Venezuela.

An estimate, based entirely on the community-based data, was projected for the total annual number of diarrheal episodes in children in Venezuela. It was estimated there are 1,320,000 episodes annually (600,000 X 2.2/child), of which 101,400 (600,000 X 0.169/child) are caused by rotavirus and require treatment or a visit to a doctor. Of the projected annual number of infected children, 12,000 would be expected to have rotavirus diarrhea with dehydration (600,000 X 0.02 episode/child/year).

There is little information on hospital costs in Venezuela, and what information does exist is questionable. Therefore, the annual cost of rotavirus illness could not be estimated.

The economic impact of rotavirus immunization, however, is of concern in developing countries. The cost of administering routine rotavirus vaccines could be expensive in such countries and, therefore, require that governments making public health policy decisions on immunizations do so on the basis of the cost versus the savings per case of severe diarrhea prevented. In addition, it would be useful to know the threshold vaccine cost from the perspective of the health care system. To arrive at any of these estimates, it is essential to know the incidence and the burden of rotavirus disease and the cost estimates in individual national settings.

In the United States, various studies have been done on the cost benefit, cost effectiveness, and economic impact of rotavirus immunization [5, 16, 17]. These studies have shown that the rotavirus vaccine is to be both cost effective and cost saving.

**Conclusion**

In summary, in Venezuela, 1,320,000 diarrheal episodes will probably occur annually among children in their first 2 years of life. One in every 33 children born will be hospitalized for rotavirus gastroenteritis, and 1 in 50 will have an episode of dehydration each year. Although extrapolation of the community-based data to national estimates could be risky and limited, it is nevertheless useful for determining public health policy and cost benefits and for monitoring the impact of rotavirus vaccination programs.

**Acknowledgment**

I thank Marian Ulrich for reading the manuscript.

**References**


