

Hospitalization costs associated with diarrhea among children during the period of rotavirus circulation in the Northwest region of Argentina

Norberto D. Giglio, M.D.,^a Martín Caruso, M.D.,^b Vanesa E. Castellano, M.D.,^a Liliana Choque, B.S.,^b Silvia Sandoval, B.S.,^b Paula Micone, M.D.^c and Ángela Gentile, M.D.^a

ABSTRACT

Objective. To assess direct medical costs, out-of-pocket expenses, and indirect costs in cases of hospitalizations for acute diarrhea among children <5 years of age at Hospital de Niños "Héctor Quintana" in the province of Jujuy during the period of rotavirus circulation in the Northwest region of Argentina.

Methods. Cross-sectional study on disease-related costs. All children <5 years of age, hospitalized with the diagnosis of acute diarrhea and dehydration during the period of rotavirus circulation between May 1st and October 31st of 2013, were included. The assessment of direct medical costs was done by reviewing medical records whereas out-of-pocket expenses and indirect costs were determined using a survey. For the 95% confidence interval of the average cost per patient, a probabilistic bootstrapping analysis of 10 000 simulations by resampling was done.

Results. One hundred and five patients were enrolled. Their average age was 18 months (standard deviation: 12); 62 (59%) were boys. The average direct medical cost, out-of-pocket expense, and lost income per case was ARS 3413.6 (2856.35-3970.93) (USD 577.59), ARS 134.92 (85.95-213.57) (USD 22.82), and ARS 301 (223.28-380.02) (USD 50.93), respectively. The total cost per hospitalization event was ARS 3849.52 (3298-4402.25) (USD 651.35).

Conclusions. The total cost per hospitalization event was within what is expected for Latin America. Costs are broken down into direct medical costs (significant share), compared to out-of-pocket expenses (3.5%) and indirect costs (7.8%).

Key words: Childhood diarrhea, rotavirus, health expenditure, personal finance.

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- Division for the Promotion and Protection of Health, Epidemiology Area, Hospital de Niños "Ricardo Gutiérrez," Autonomous City of Buenos Aires.
- Hospital de Niños "Dr. Héctor Quintana," San Salvador de Jujuy, Argentina.
- Hospital Durand, Autonomous City of Buenos Aires, Argentina, Argentina.

E-mail address:

Norberto D. Giglio, M.D.:
norbergiglio@gmail.com

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INTRODUCTION

Rotavirus infection affects mainly children younger than 5 years and caused approximately 528 000 deaths per year before the vaccine was introduced. It has been estimated that, following vaccine introduction, mortality has reduced to a half.¹

More than 90% of deaths occur in developing countries. In Argentina, between 1 100 000 and 1 250 000 cases of acute diarrhea are reported each year, and 45-50% occur in children younger than 5 years. The highest rate of rotavirus-associated diarrhea is in the Northwest region of Argentina (NOA), with 41.6% of positive results out of all samples analyzed in the 2009-2011 period.^{2,3}

Jujuy, a province on the border with Bolivia, is among the regions of Argentina with the largest indigenous population or descendants of indigenous peoples belonging to nine different ethnic groups. Part of this population lives in rural areas in the mountains, away from the capital city. Also, 53% of the population living in Jujuy has some kind of health coverage whereas 15% has unmet basic needs.^{4,6}

Certain characteristics such as health care patterns, difficulties to provide a close follow-up in outpatient offices, and caregivers' level of education and beliefs lead to assuming that in the province of Jujuy there may be specific utilization and cost patterns.

The objective of this study was to assess direct medical costs, out-of-pocket expenses, and indirect costs in cases of hospitalizations for acute diarrhea in children <5 years of age

at Hospital de Niños "Héctor Quintana" in the province of Jujuy during the period of rotavirus circulation in the NOA.

MATERIAL AND METHODS

This was a cross-sectional study conducted during the rotavirus circulation period among children younger than 5 years who attended the Hospital de Niños "Héctor Quintana", in the capital city of Jujuy. This is a tertiary care (level III) referral hospital for the entire province with approximately 170 000 visits and 5500 discharges each year.

The rotavirus circulation period was estimated to be between May 1st and October 31st of 2013, based on the prevalence of viral circulation in the previous years.³

All patients who met the definition of acute diarrhea⁷ and who also required hospitalization for oral rehydration therapy (plan B) or intravenous rehydration therapy (plan C)⁸ were included in the study. Patients whose parents refused to participate in the study were excluded.

Once the informed consent was signed, direct medical costs were assessed by reviewing medical records. All resources associated with each day of hospitalization, diagnostic tests, and medications were included.

Out-of-pocket expenses and indirect costs were obtained based on a structured survey administered to parents or caregivers based on the World Health Organization's Guidelines for estimating the economic burden of diarrheal disease, with focus on assessing the costs of rotavirus diarrhea.⁹ The survey was translated into Spanish, cross-culturally adapted, and pilot-tested (see *Annex 1*).

Transportation, private office consultation visits, medication, and other expenses incurred by parents or caregivers were included. Any lost income related to absenteeism from work was considered an indirect cost.

Nurses trained on cost assessment collected data from medical records and administered the survey to parents or caregivers.

Unit costs were described in Argentine pesos based on health care service rates corresponding to the second semester of 2013. The exchange rate was USD 1= ARS 5.91 based on the average price recorded for that semester. Unit costs were provided by the hospital's Department of Administration.

The mean and standard deviation (SD) for quantitative outcome measures were estimated

using the Epi Info software, version 6.0;¹⁰ confidence intervals (CIs) of ratios or percentages were calculated with OpenEpi 2.2.1.¹¹ To estimate the 95% CI of the average cost per patient, a probabilistic bootstrapping analysis of 10 000 simulations by resampling was done.¹²

The protocol was approved by the Provincial Committee of Bioethics of the General Division of Health Research of the province of Jujuy.

RESULTS

During the study period, 105 patients were hospitalized for acute diarrhea; of these, 93 received an initial diagnosis of diarrhea in the Emergency Department, and 12 were diagnosed with diarrhea-associated dehydration. Most patients were from urban populations (90.4%). All parents and caregivers accepted to participate in the study.

The average age of patients was 18 months old (SD: 12); 62 (59.04%) were boys, and 41 (39.4%) of cases had a history of prior infections, mostly pneumonia, followed by urinary tract infection and a history of anemia and bronchial hyperresponsiveness.

Out of all hospitalized patients, 77 (73.3%) had made a previous visit to the hospital's Emergency Department and their stay lasted 2.57 hours (SD: 3.05), and 44 (41.9%) had visited the outpatient offices, with a stay that lasted 1.37 hours (SD: 1.54); 16 patients had visited both the Emergency Department and the outpatient offices.

Once hospitalized, patients' hydration status was assessed and 19 (18.1%), 83 (79.5%), and 3 (2.86%) had mild, moderate, and severe dehydration, respectively. None of the hospitalized patients required admission to the intensive care unit and nor died as a result of the cause of hospitalization. *Table 1* describes resource utilization and unit costs at the hospital.

Out of all patients, 41 (39.05%) received antipyretics; 27 (25.71%), antacids; 6 (5.71%), antiemetics; and 30 (28.57%), antibiotics. The total medication cost was ARS 235.18 (USD 39.79) per patient. *Table 2* describes the average direct medical costs of the studied sample.

In relation to out-of-pocket expenses, 58 patients indicated that they had paid for private office consultation visits, medications, and diagnostic methods for an average expense of ARS 146.94, CI: 87.45-206.43 (USD 24.86, CI: 14.97-34.92), and the average expense per hospitalization event was ARS 81.16, CI: 48.3-114 (USD 13.73, CI: 8.17-19.28) for all cases.

Families of the 105 hospitalized patients spent an average of 1 hour to get to the hospital (57.5 h, SD: 53). In terms of means of transportation, 74 (70.48%) families used the bus; 27 (25.71%), took a cab or a private taxi; 3 (2.86%) arrived by ambulance; and 1, by foot. To get to the hospital, families made an average of 2.47 + 1.54 trips prior to hospitalization and 3.19 + 3.6 trips while the child was hospitalized. The total average cost per trip prior to and during hospitalization was ARS 53.74, CI: 37.69-99.57 (USD 9.09, CI: 6.37-16.84) per patient. Based on these findings, it was possible to estimate an average out-of-pocket expense per hospitalization event of ARS 134.92, CI: 85.99-213.57 (USD 22.82, CI: 14.54-36.13).

In relation to indirect costs, among all surveyed participants, 104 parents referred an average lost income of ARS 301, CI: 223.28-380.02 (USD 50.93, CI: 37.78-64.3) per hospitalization event. Of these families, 56 (53.33%) reported that they had a stable job or worked in a store.

Based on these findings, the cost per event per hospitalized child was estimated at ARS 3849.52, CI: 3298-4402.25 (USD 651.35, CI: 558.03-744.88).

DISCUSSION

Consistent with what has been described in the epidemiology of this disease, our results show that diarrhea episodes during the rotavirus circulation period mostly affect children younger than 2 years, and a correlation was observed between the protocol-defined period and rotavirus circulation in the study year.²

Medical costs for a patient hospitalized for diarrhea were estimated at ARS 3849.52 (USD 651.35). Although it is very difficult to compare costs among different countries, our results are similar to those described by other authors. Takemoto et al.¹³ stated that, for a total of 21 studies conducted in Latin America, the cost per hospitalized patient ranged from USD 95.65 to USD 1002.10, with a mean of USD 400.58.

In relation to cost breakdown structure, most publications describe that direct medical costs account for most costs compared to out-of-pocket expenses and indirect costs. In our study, productivity losses and out-of-pocket expenses accounted for 3.5% and 7.8%, respectively, of the total cost per hospitalization event. In the United

TABLE 1. Resource utilization and unit costs (N= 105)

	No. of subjects	Average units used and SD	Unit cost in ARS
Visit to the hospital office	44 (41.9%)	1	55
Visit to the Emergency Department	77 (73%)	1	54
Hospital day	105 (100%)	4.26 + 3.96	637
Parasitology (stools)	12 (11.43%)	1	22.5
Leukocytes (stools)	89 (84.76%)	1.01 + 0.10	22.5
Stool culture	54 (51.43%)	1.05 + 0.23	60
Electrolytes	67 (63.8%)	1.4 + 1.03	26.25
Blood glucose	57 (54.29%)	1.26 + 0.74	11.25
Urea	65 (61.9%)	1.2 + 0.66	11.25
Creatinine	41 (39.05%)	1.14 + 0.42	15
Blood count	88 (83.81%)	1.14 + 0.57	22.5
Blood culture	8 (7.6%)	1.37 + 0.91	56.75
X-ray	32 (30.4%)	1.78 + 1.75	50
Fecal virus (ELISA)	34 (32.38%)	1	100
ORS*	69 (65.7%)	2.21 + 1.57	33.5
Intravenous rehydration vials	102 (97.14%)	5.1 + 2.96	33.5

*ORS: oral rehydration solution; SD: standard deviation; ELISA: enzyme-linked immunosorbent assay.

TABLE 2. Direct medical costs (N= 105)

Average cost of a visit to the Emergency Department	AR\$ 39.6 (USD 6.7)
Average cost of a visit to a hospital office	AR\$ 23.04 (USD 3.89)
Total average cost associated with hospital length of stay	AR\$ 2713.6 (IC 2238.46-3188.73) (USD 459.15, IC 378.75-539.54)
Total average cost of diagnostic tests and treatment	AR\$ 637.39 (IC 557.98-716.8) (USD 107.84, IC 94.41-121.15)
Medical cost per hospitalization event	AR\$ 3413.6 (IC 2856.35-3970.93) (USD 577.59, IC 483.3-671.9)

States, the cost per hospitalization event for gastroenteritis was estimated at USD 4780, where out-of-pocket expenses accounted for 1.2% and indirect costs, 5%.¹⁴ In Kenya, the direct medical costs of hospitalized patients were estimated to be between USD 173 and USD 231; productivity losses, at USD 10 (4%); and transportation expenses, at USD 20 (8%).¹⁵ The predominance of medical costs over out-of-pocket expenses and productivity losses in association with hospitalization for diarrhea was also described by Rheingans et al.¹⁶ in 2007; the same distribution pattern is observed in Argentina, Brazil, Chile, Dominican Republic, Honduras, Mexico, Panama, and Venezuela.

Unlike what has been described before, the study conducted in Taiwan among patients hospitalized for rotavirus gastroenteritis showed that the cost per event was USD 874, direct medical costs accounted for USD 382 (43.7%), out-of-pocket expenses, USD 294 (33.63%), and indirect costs, USD 185 (22.67%).¹⁷

The economic conditions of each country may account for cost proportions described here. In Argentina, the rate of unemployment and the cost of public transportation services explain the differences observed between direct medical costs, out-of-pocket expenses, and indirect costs associated with productivity losses.

In the province of Jujuy, the estimated rate of employment was 37%¹⁸ and together with the low cost of public transportation, which is subsidized by the government,¹⁹ result in the families of hospitalized patients (70.48%) incurring in low costs.

Considering that the minimum salary for the fourth quarter of 2014 was ARS 4716 (USD 535.90),²⁰ a hospitalization for gastroenteritis has an impact on family income and may reduce it by up to 9.2%. The same scenario has been described in Argentina by Gentile et al.²¹ regarding costs associated with hospitalization for *Bordetella pertussis*, where out-of-pocket expenses and productivity losses accounted for 4% of the total event costs; this meant an 8% reduction in the average salary for each family of hospitalized patients.

Our study has some limitations because it was conducted in only one hospital and most patients came from urban areas, and this may result in a bias of provincial or rural area representativity. The costs quantified in this study were related to hospitalizations for diarrhea during the rotavirus circulation period but it was not confirmed

whether these infections were actually associated with rotavirus; this may result in a bias regarding the implications of costs associated with this disease.

Finally, considering that the population of children younger than 5 years in Jujuy is 60 753 inhabitants,²² with an annual hospitalization rate of diarrhea patients prior to vaccine introduction of 9000 per 100 000 children,^{23,24} it is expected that there would be 5468 hospitalizations for acute diarrhea, 41% of which would be caused by rotavirus.³ From the perspective of society, the annual cost related to acute diarrhea would be USD 3 561 582, of which USD 1 460 248 would correspond to rotavirus diarrheas.

Acute diarrhea is one of the main causes of avoidable morbidity and mortality caused by dehydration among children younger than 5 years in developing countries. Rotavirus diarrhea prevention via immunization together with oral rehydration therapy and timely access to health care services constitute a fundamental strategy to prevent hospitalizations and deaths.

Argentina introduced the rotavirus vaccine in 2015 in a schedule of 2 doses at 2 and 4 months old. Based on effectiveness and efficacy data developed in the region, a major reduction in the burden of disease and diarrhea-associated costs are expected in the next years.

CONCLUSION

Our findings show that the total cost per hospitalization event is within what is expected for Latin America. Costs are broken down into direct medical costs (significant share), compared to out-of-pocket expenses (3.5%) and indirect costs (7.8%). ■

Conflict of interest

None of the authors is related to Merck Sharp & Dohme Corp. Argentina in this study and have not charged a fee.

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ANNEX
QUESTIONNAIRE ABOUT OUT-OF-POCKET EXPENSES AND INDIRECT COSTS

1. Record number:

2. Facility name:

3. Facility code:

4. Type of facility where you sought care prior to hospitalization:

Public

Trade union health insurance

Private

Tertiary care hospital

General hospital

Health care center

5. Patient information

- ID number:
- Medical record number:
- Date of birth:
- Sex: -Male -Female
- Informed consent date:
- Origin: -Urban -Rural -Unknown
- Relationship between the patient and the caregiver:
 - Mother
 - Father
 - Sister
 - Brother
 - Grandfather
 - Grandmother
 - Friend
 - Other family member

6. How long did it take you to get to the hospital from your home?:

Minutes

Hours

Unknown

7. What kind of transportation do you use to get here? (in case of multiple means of transportation, please tick only the means of transportation that is used for the longest distance):

- Car (your own or from a family member)
- Bus
- Train
- Bicycle
- Motorbike
- Cab or private taxi
- By foot
- Boat
- Ambulance
- Other

8. **If you pay for transportation to come to the hospital, please specify how much you pay every time you come here (write 0 if no payment is made):**
9. **How many trips did you and your child make prior to hospitalization?:**
10. **How many times did you make the same trip since your child was hospitalized until discharge?:**
11. **If you paid for transportation to make these visits, please specify how much you paid in total (write 0 if no payment was made):**
12. **Before visiting this facility, how much did you spend in medication, diagnostic tests, and consultation visits?:**
13. **Have you lost working days (income) for coming to the hospital?: -Yes -No**
14. **If you weren't here today, what would you be doing?:**
 - Nothing
 - Housework
 - Looking after my children
 - Working (specify):
 - Other (specify):
 - Don't know
15. **How much income have you and other family members lost as a result of coming to the hospital with your child since hospitalization until discharge?**
16. **How many people share your household?**
 - Adults: -18-28 years old: -29-38 years old: -39-48 years old: -49 years or older:
 - Children: -0-5 years old: -6-10 years old: -11-17 years old:

Survey completed by:

Identity document:

Date: