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Cost Analysis of Rotaviral Treatment in Libyan Public Hospitals

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Abstract: Limited data exist on economic burden of rotavirus gastroenteritis in Libya. Aim of this study is to perform cost analysis of rotavirus disease in Libya. A prospective cross sectional study was conducted among rotavirus children aged below five years from August 2012 to April 2013 at three public hospitals in Libya. The cost of rotavirus treatment is calculated the cost of rotavirus treatment from the hospital and patient's perspective for hospitalized and ambulatory case. A total of 311 patients were enrolled in this study. Of these 239 cases were inpatients while 72 cases were outpatients. The average treatment cost of a hospitalized rotavirus episode was US\$ 667.76 and out of this US\$ 480.36 (72%) was by the hospital, while US\$ 187.40 (28%) by the patient. The average cost of treatment for ambulatory rotavirus case was US\$ 166.34, of which US\$ 120.02 (72%) was from hospital cost and US\$ 46.32 (28%) from patient's cost. These costs for inpatient and outpatient were during the whole treatment period. Hospital and patient's cost of rotavirus treatment showed the disease posed a considerable economic burden on Libyan government and families. Applying preventive measures would be more appropriate such as introducing rotavirus immunization to reduce the disease.

Key words: *Rotavirus*, treatment, public hospitals

INTRODUCTION

Rotavirus infection posed a significant disease and an economic burden on health facilities and society. The virus is a substantial cause of severe gastroenteritis in infants and young children worldwide and can lead to deaths in poor countries where the health services are insufficient (WHO, 2005; Standaert *et al.*, 2008; Dalby-Payne and Elliott, 2009; WHO, 2009a; CDC, 2010a). Even developed countries are also experiencing a sharp increase brought about by the economic burden of the primary health care system (Gray *et al.*, 2008; Parashar and Glass, 2009). Rotavirus has been infecting around half of all gastroenteritis cases among children aged below 5 years (PAHO, 2003; Sartori *et al.*, 2008; Valencia-Mendoza *et al.*, 2008; WHO, 2008; Cortese *et al.*, 2009; Patel *et al.*, 2009; WHO, 2009a; Patel *et al.*, 2011). Young children and infants were more susceptible to be infected by this disease (WHO, 2009c; WHO, 2009b). Children can be treated and deaths can be prevented by establishing a therapy program for gastroenteritis patients using the rehydration method (WHO, 2005; Ghenghesh *et al.*, 2008). Injecting rotavirus vaccine as intervention could decrease the burden of the disease by more than 85%; the vaccine is safe and has high efficacy rate (Tom-Revzon, 2007; Masters, 2007; Dalby-Payne and Elliott, 2009; CDC, 2010b; NNII, 2010). To see the financial

benefits of rotavirus vaccination warrants costing of the rotavirus treatment. The outcome could then be used to provide a persuasive economic evaluation of the intervention (Husereau *et al.*, 2013). The treatment cost of rotavirus infection includes hospital medicinal costs and patient's costs, as well as other costs that would have to be borne by the society. Medicinal costs include visits to the doctor and emergency room, hospitalization and the cost of laboratory diagnosis, as well as patient's costs such as the loss of earnings (WHO, 2005; Gray *et al.*, 2008). Up to date, there is no known study on the economic burden of rotavirus infection in Libya. In this study, cost analysis on the treatment of rotavirus gastroenteritis was conducted to show the economic burden that the disease posed to public hospitals. The findings could be further used in other economic evaluations such as cost-effectiveness or cost-benefit analysis that could assist the stakeholders in developing policy on investing for rotavirus vaccination.

METHODS

A prospective cost analysis of gastroenteritis caused by rotavirus was conducted at three main hospitals at the district of Zliten and Khoms, Libya, in 2012. The stipulated cost was from the hospital and patient's perspectives. Cost of rotavirus disease was calculated for

treatment of hospitalized and ambulatory cases. Analysis of cost was only made on cases of gastroenteritis confirmed with rotavirus infection by laboratory investigation. The final cost reported is the average cost of treatment at the hospitals. Cost of all items were collected for each patient and presented as average of all patients in the study.

Hospital costs: Hospital cost included in this study were cost per day of hospital stay (Per Diem), it was accounted as one if the patient admitted for observation and treatment for an overnight stay and half if the patient spent less than 12 h in the paediatric ward or at the outpatient clinic (WHO, 2005). Cost of per diem included staff salaries and total hotel costs. The hotel cost consists of cost of furniture, equipments, food for patient, laundry, disposal, cleaning, utilities and maintenance, which were obtained only from Zliten hospital management since all study hospitals are supported from same source, government. Capital cost such as building cost and its fittings were not performed since the hospitals were built more than 20 years ago. Data for costing and hospital statistics were obtained from the financial department and medical records, respectively. The cost of treatment of all items for hospitalization and as ambulatory case was similar because the ambulatory care was given at the outpatient clinic which was a part of the paediatric ward and both were supported by the same source. Micro-costing was performed to obtain the medication cost which consists of drugs administered to treat rotavirus patients, whether they were in the hospital or before and after the admission. Cost of medicine was obtained from the central pharmacy at the study hospitals. The cost of diagnostic tests included all laboratory tests before and during admission.

Patient's costs: Patient's costs were expressed per unspecified day and included lost of income by parents during the treatment, reduction of household services, transportation cost for a round-trip to the hospital and payments for caregivers. The patient's cost was obtained by interviewing parents just before patient was discharged.

Statistical methods: Economic data of rotavirus infection was tested by performing t-test to obtain the outcomes such as the mean, range and standard deviation. The variations between the proprieties were examined using other tests such as the Mann-Whitney's test and Nonparametric Kruskal Wallis.

Ethical clearance: Ethical clearance was granted by University of Malaya Medical Ethics Committee (IRP 908.6). Consents were obtained from both hospitals and parents.

RESULTS

Per diem cost: Per diem cost (bed-day cost) which consists of all components related the therapy for all admission patients at the pediatric wards in 2012. The total expenditures in the pediatric ward for all admission cases were US\$ 965,060.00 in 2012. Staff salary was the highest cost (77%), while host hotel represented 24% of annual expenditures at the pediatric ward. Cost per day (Per Diem Cost) for each patient, which was derived from the total annual expenditure at the pediatric ward, was US\$ 113.94 (Table 1). Capital cost (Building Cost) was not included in the cost since the age of the hospital exceeded the life span (20 years).

Inpatient cost: A total of 311 rotavirus gastroenteritis patients were enrolled in this study. Of these, 239 were inpatient cases, while 72 were outpatient cases. The average length of hospital stay was 3.02 days at paediatric ward. The mean total cost of hospitalization for each rotavirus case was US\$ 667.76, out of this US\$ 480.36 (72%) was generated from hospital cost while US\$ 187.40 (28%) generated to patient's cost. From the hospital perspective, the highest component was from staff salary, which made up 39% of all treatment cost in the paediatric ward. Followed by medication cost was US\$ 105.68 (16%). The other items were hotel cost US\$ 80.77 (12%) and laboratory cost was US\$ 30.58 (5%). From the patient's perspective, transportation cost was the highest which was US\$ 76.98 (12%), followed by household cost at US\$

Table 1: Per diem cost for all patients below 5 years old at pediatric ward in Zliten hospital

Variables	Cost for each patient		
	Annual cost	Per day	(%)
Staff salaries			
Specialists (US\$)	153,220.00	18.09	16
Doctor (US\$)	249,600.00	29.47	26
Nurses (US\$)	133,730.00	15.79	14
Administrators (US\$)	201,980.00	23.85	21
Total (US\$)	738,530.00	87.20	77
Hotel cost			
Furniture and equipment (Ward and Clinic) cost (US\$)	8,000.00	0.94	1
Foods cost (US\$)	84,700.00	10.00	9
Laundry, disposal and cleaning cost (US\$)	89,454.40	10.56	9
Operation and maintenance cost (US\$)	44,381.60	5.24	5
Total (US\$)	226,536.00	26.74	24
Sub total cost (US\$)	965,060.00	113.94	
Zliten hospital management			

Table 2: Hospital and patient's costs for each inpatient among children below 5 years of age in the study period (N = 239)

Variables	Mean	(%)	Range
Average length of hospital stay	3.02		1-15
Hospital cost			
Capital cost	0.00		0
Staff salaries (US\$)	263.33	39	43.50-1,304.00
Hotel cost (US\$)	80.77	12	13.30-399.90
Medication cost (US\$)	105.68	16	12.80-2,737.00
Laboratory cost (US\$)	30.58	5	13.60-90.40
Total US\$	480.36	72	83.20-4,531.00
Patient's cost			
Transportation cost (US\$)	76.98	12	8.00-760.00
Household cost (US\$)	68.82	10	16.00-464.00
lost income (US\$)	41.60	6	0-1,200.00
Total (US\$)	187.40	28	24.00-2,424.00
Sub total cost (US\$)	667.76		196.00-5,324.00

Table 3: Hospital and patient's costs for each outpatient among children below 5 years of age in the study period (n = 72)

Variables	Mean	(%)	Range
Average length of clinic stay	0.52		0-2
Hospital cost			
Capital cost	0.00		0
Staff salaries (US\$)	45.34	27	43.50-173.7
Hotel cost (US\$)	13.91	8	13.13-53.29
Medication cost (US\$)	40.14	24	19.20-426.00
Laboratory cost (US\$)	20.63	12	13.60-39.20
Total US\$	120.02	72	89.60-692.20
Patient's cost			
Transportation cost (US\$)	10.89	7	8.00-192.00
Household cost (US\$)	27.10	16	16.00-416.00
lost income (US\$)	8.33	5	0-480.00
Total (US\$)	46.32	28	24.00-1,088.00
Sub total cost (US\$)	166.34		118.00-1,081.00

68.82 (10%) and lost income of US\$ 41.6 (6%). Table 2 shows the details of treatment cost for hospitalised rotavirus infection.

Outpatient cost: The average length of stay was 0.52 day at outpatient clinic during the visit or IVF treatment. The mean total cost of treating a rotavirus infection as ambulatory case was US\$ 166.34, out of which US\$ 120.02 (72%) was from hospital's perspective while US\$ 46.32 (28%) was from patient's cost. For the hospital cost, the cost of staff salaries was the highest cost US\$ 45.34 (36%) followed by medication and laboratory cost at US\$ 40.14 (24%) and US\$ 20.63 (12%), respectively. Hotel cost was 8% of total cost to treat rotavirus outpatient. For the patient's cost, the household cost was the highest which was US\$ 27.10 (16%) followed by transportation and lost income which was US\$ 10.89 (7%) and US\$ 8.33 (5%), respectively. Table 3 shows the details of treatment of rotavirus infection as ambulatory case. The previous calculations were during the whole therapy period.

DISCUSSION

Most countries defined rotavirus disease as a major cause of acute gastroenteritis, which has significant

financial impact on health facilities usage. Economic studies pertaining to the economic burden of rotavirus was not conducted in Libya before this study because the monetary benefit of introducing healthcare services to all patients was not the goal in public hospitals. The government of Libya through the ministry of health is responsible for the delivery of healthcare services to all citizens at no charge (WHO, 2007). The study interested to analysis the treatment cost of rotavirus on hospitals and families. No study identified the national rotavirus gastroenteritis cases yet, thus we cannot apply our result to whole cases in the country to estimate the national burden caused by rotavirus infection. The burden of the disease on hospital was demonstrated; accordingly, more than 72% of the total costs of rotavirus treatment were from the hospitals and 28% came from out of pocket, whether inpatient and outpatient. In Libya, the public hospitals provides all health services to Libyan free of charge and the cost of per diem was not determined by the public hospitals, which made us to calculate the per diem from all items related to bed-day cost at the pediatric ward. The treatment cost for each rotavirus patient was US\$ 113.94 for each day in Zliten hospital.

The hospital cost for inpatient and outpatient was US\$ 667.76 and US\$ 166.34 of the treatment cost, respectively. The total hospital cost for ambulatory or outpatient was lower than hospitalised or inpatients because there were no reservations made for beds. In the study, the hospitalization cost, including bed-days cost, medications and laboratory tests, was the highest factor that made up 72% of all costs for each rotavirus patient, which was almost similar to the hospitalization cost of rotavirus in children below 5 years of age in the US, which was about 66% as calculated treatment cost of rotavirus infection before vaccination was implemented (Tucker *et al.*, 1998). The payment incurred by parents for caring their child's admission with rotavirus infection was estimated at 22% (US\$ 187) of the total monthly income, while in Hong Kong the family normally spent around 10% (US\$ 120) of the monthly salary (Nelson *et al.*, 2005).

In this study, the economic burden of rotavirus infection was substantial considering the average annual income of US\$ 10,300 (World Bank, 2012) with the extensive evidences on the effectiveness and relative affordability of rotavirus vaccine, it is empirical that the government of Libya considers in investing on the vaccine. Applying the treatment cost for each patient in the study to national rotavirus cases can yield an estimate of the national economic burden on public hospitals. Moreover, having the cost of rotavirus infection, further economic evaluation such as cost-effectiveness and

cost-benefit analysis would be of assistance to the stakeholders in deciding on a policy for immunization against rotavirus infection among the children in Libya.

CONCLUSION

The cost of treatment of rotavirus infection among children in Libya posed substantial economic burden to the government. With the available cost data, a cost-effectiveness analysis is warranted to provide evidence that can be used for deciding on investing in rotavirus vaccines.

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