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ORIGINAL ARTICLE

Cost-effectiveness of rotavirus vaccination in Turkey



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Abstract *Background/Purpose:* Cost-effectiveness studies about rotavirus (RV) vaccination programs were performed in many countries due to the severe economic burden of RV infections. This study is an economic evaluation performed to assess the potential for introducing the RV vaccine to the Turkish National Immunization Program.

Methods: In this retrospective clinical study, the records and laboratory findings of a total of 4126 patients admitted to Turgut Ozal University Hospital, Ankara, Turkey with acute gastroenteritis were analyzed. A model described by Parashar et al. was used to obtain the annual episodes of diarrhea, hospitalization and outpatients visits in Turkey. Monovalent and pentavalent vaccination was assumed to protect in average 85% of RV acute gastroenteritis. All costs are expressed in 2012 United States (US) \$, where US\$1 equals 1.8 Turkish Liras (TL). Losses of labor costs were not taken into consideration.

Results: The vaccination program with 85% coverage was cost effective and cost saving compared to no vaccination. A projected birth cohort of 1.25 million children was followed until 5 years of age; a routine vaccination could potentially avert 210,994 cases of diarrhea treated in outpatient hospital facilities and 42,715 hospitalizations. The RV associated economic burden was obtained as US\$17,909 million per year (US\$14.33 per birth annually) in medical direct costs by using the national level of RV diarrhea disease burden estimates. For monovalent and pentavalent vaccination, assuming a cost of US\$31.5 and US\$38 per vaccine course, the cost of the vaccination program was estimated to be approximately US\$37,878 million and US\$45,475 million, respectively.

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Conclusion: At a cost per vaccine course of US\$31.5 for monovalent and US\$38 for pentavalent vaccine, routine RV vaccination could be potentially cost effective and also cost saving in Turkey. National RV vaccinations will play a significant role in preventing RV infections. Copyright © 2016, Taiwan Society of Microbiology. Published by Elsevier Taiwan LLC. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Rotavirus (RV) is the most frequent cause of acute gastroenteritis (AGE) and AGE-related hospitalizations throughout the world in children under 5 years. Rotavirus-related gastroenteritis accounts for 10–20% of AGE and 25–55% of AGE-related hospitalizations.¹ Rotavirus diarrheas cause 111 million diarrheal episodes yearly worldwide. Due to this, 25 million outpatients and two million children stay in hospital.² Annually 611,000 children die due to severe RV diarrhea and 85% of deaths occurs in developing countries.³ Incidence of RV which is distinguished from other gastroenteritis agents by not being related to socioeconomic conditions and hygiene measures is the same in developed and developing countries; while its mortality is high in developing countries; it leads to high morbidity and economic losses in developed countries.^{3,4} Studies indicate that RV is one of the main causes of gastroenteritis among children aged between 0 years and 5 years in Turkey.⁵ Rotavirus infections may be asymptomatic or cause nonspecific symptoms like diarrhea, vomiting, and fever. The frequency of RV infection increases in winter.⁶

Directly and indirectly, the annual cost of RV infections to the United States is \$1 billion and to the Europe is €350 million, approximately.^{7,8} Rotavirus infections cause economic burden both for the families and the countries not only due to hospitalizations but also as a result of outpatient clinic admissions and loss of labor.⁹

There is no particular therapy for RV infection. Immunization plays a significant role for RV related morbidity and mortality and currently two vaccines are available.¹⁰ Rotarix (GlaxoSmithKline, Rixenrant, Belgium) and RotaTeq (Merck Sharp&Dohme Corp., Whitehouse Station NJ, USA), two vaccines developed against RV infections, are reported to reduce hospital and emergency room admissions by 90%.⁹ These vaccines which have been used in many countries since 2006 are currently included in routine vaccination programs in more than 100 countries.¹¹ Studies about cost-effectiveness of routine vaccination continue as vaccine prices are so high in many countries all over the world.¹² It was difficult to use the health data of one country for another because of differences between epidemiology and health system of countries.¹³ In this study, we aimed to calculate the financial burden of outpatients and hospitalized RV patients. According to financial burden results, we estimated the cost of RV vaccines in Turkey in which RV vaccines have not been included in routine vaccination programs yet.

Methods

In this study, records and laboratory data of 4126 patients younger than 5 years, who were admitted to the

Department of Pediatrics, Faculty of Medicine, Turgut Ozal University, Ankara, Turkey with AGE between January 2005 and May 2012 were retrospectively analyzed. Rotavirus antigens were investigated in fresh stool specimens with the “qualitative immunochromatographic” test (CerTest Rotavirus kit, Biotec, Zaragoza, Spain).

This study was estimated to cover three types of hospital (university, public, and private) costs available in Turkey and represented an average cost of gastroenteritis due to RV. All patients admitted to the Turgut Ozal University Hospital, Ankara, Turkey were assumed to be admitted to a public and a private hospital. This study was approved by the Human Subjects’ Research Committees at the Faculty of Medicine, Turgut Ozal University.

A resolution analytical model has been developed to predict the effectiveness and cost effectiveness of RV in the childhood population (< 59 months of age) with the opportunity to focus the analysis on a risk based vaccination program. Demographic and epidemiological inputs were obtained from previously conducted study sources from different regions of Turkey and international literature.

To compare the costs of the vaccination versus non-vaccination situation and health outcomes, an incremental cost-effectiveness ratio (ICER) was estimated as the incremental cost per life year gained (LYG). Since there are no health utility data available in Turkey, the quality of life gained due to vaccination has not been evaluated. ICER compares the net cost of a health intervention with the benefit gained. The ICER was calculated for a range of vaccine prices [United States (US)\$1–40 per vaccine course].

Bills of the in- and outpatients for RV gastroenteritis were analyzed in detail and direct medical costs were calculated as in the studies investigating economic burden of RV infections at University Hospital. After the interviews with government health officials and private hospital managers in Ankara in 2012, estimates of costs were obtained. Medical direct costs for RV-specific diarrhea were estimated for the 2012 Turkey birth cohort. Nondirect medical and indirect costs were not taken into account in the model. All costs are expressed in 2012 US\$, where US\$1 equals 1.8 Turkish Liras (TL).

A model described by Parashar² was used to obtain the annual episodes of diarrhea, hospitalization and outpatients visits in Turkey. Among the 1.25 million births annually in Turkey (7.5 million children younger than 5 years in 2012), the annual episodes of diarrhea in Turkey was estimated to be 13,371,800 among children younger than 5 years, corresponding to 94,817 hospitalizations and 1,182,046 outpatient visits (Table 1).¹⁴ Rotavirus AGE comprised 21% of the outpatient AGE cases¹⁵ and RV gastroenteritis among all children hospitalized for

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