# Hospitalizations Associated With Rotavirus Gastroenteritis in the United States, 1993–2002

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**Background** : In the United States, rotavirus gastroenteritis remains a common disease of children that results in many hospitalizations, clinic visits and medical costs. It is a common cause of morbidity and is associated with a high economic burden in developing countries. Prevention of hospitalizations is the primary target of rotavirus vaccines.

**Methods:** To update estimates of rotavirus hospitalization rates in the United States, we conducted a retrospective analysis of 10 years of national hospitalization data associated with gastroenteritis and used both direct and indirect methods to estimate the percentage of cases associated with rotavirus gastroenteritis.

**Results:** During 1993–2002, an average of 18% of all hospitalizations with gastroenteritis among children <5 years old were associated with rotavirus infection as determined by the rotavirus-specific International Classification of Diseases, 9th revision, Clinical Modification code. The annual proportion of rotavirus-associated hospitalizations increased from 15% in 1993–1995 to 21% in 2000–2002. Hospitalizations associated with rotavirus and those associated with nonspecific gastroenteritis had a marked wintertime seasonality and similar age distribution, which peaked among children between 3 and 24 months old. Using indirect estimation methods, 58,000 to 70,000 rotavirus-associated hospitalizations were estimated to occur each year in the United States.

**Conclusions:** Rotavirus gastroenteritis remains an important cause of hospitalizations in the United States, and the rate has not declined from 1993 through 2002.

**Key Words:** rotavirus, gastroenteritis, United States, hospitalizations

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Rotavirus gastroenteritis remains a common cause of hospitalizations and clinic visits in developed countries and is associated with significant economic burden. In the United States, studies conducted almost a decade ago estimated that each year, rotavirus was responsible for more than 50,000 hospitalizations[1,2] and 500,000 outpatient and emergency department visits annually at a cost exceeding one billion U.S. dollars.[3] Because of this disease burden, a rotavirus vaccine was recommended for routine immunization of U.S. infants when it was licensed in 1998.[4] This vaccine was withdrawn the next year because of an association with intussusception.[5] However, new vaccines against rotavirus may be licensed and recommended for use in the United States in the next 2 years.[6–8]

Decisions on the introduction of new rotavirus vaccines will require more current estimates of the burden of rotavirus disease. The principal goal of a U.S. rotavirus immunization program will be to prevent hospitalizations for severe rotavirus gastroenteritis. Recent data from hospital-based studies in the United States,[9] Latin America[10] and Asia[11,12] indicate that the fraction of gastroenteritis hospitalizations that are attributable to rotavirus among children under 5 years of age may be much higher than older studies used for deriving national estimates.[13] The National Hospital Discharge Survey (NHDS) has been used to monitor the occurrence of gastroenteritis- and rotavirus-associated hospitalizations since 1979, and it provides the opportunity to follow long-term (24 years) trends in disease using a single, stable source of surveillance data.[1,2,14] For the current study, we used NHDS data to update previous estimates of gastroenteritis- and rotavirus-associated hospitalizations that were provided previously for the periods 1979–1992 and 1993–1995.[1,2,14] We also report an analysis of diarrheal-associated disease hospitalizations from 1993 (when rotavirus-specific diagnosis codes became available) through 2002 to reassess the need for a rotavirus vaccine and to determine trends in disease and age-, sex- and region-specific rates of rotavirus-associated hospitalizations.

## MATERIALS AND METHODS

Hospitalization discharge records were obtained from the NHDS for 1993 through 2002.[15] NHDS data consist of a representative sample of patient discharge records obtained from short-stay, nonfederal, general and children's hospitals in the United States. for children <5 years of age with acute gastroenteritis or diarrhea listed as one of the diagnoses. Nationally representative estimates of diarrhea-associated hospitalizations were calculated using the NHDS weighting methodology. Individual identifiers are not available and a hospitalization was the unit of analysis.

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