

Global and national estimates of deaths under age five attributable to rotavirus infection: 2004.  
as of 31 March 2006

**Global deaths under age five attributable to rotavirus infection, 2004  
527 000 (475 000 - 580 000)**

Seventy-six studies from 39 countries with data collected between 1990 and 2003 documenting the proportion hospitalized diarrhoea under five years of age in which rotavirus was detected were identified. The proportions ranged from 16% to 66% with a median proportion of 38% (inter-quartile range, 26% - 43%), figure 1.

Five country groups were constructed based on geography and WHO mortality strata and each of the 192 countries were assigned to one of these groups. Based on the country in which the study was conducted, results from the above 76 studies were assigned their respective country groups, figure 2.

The R meta library ([www.r-project.org](http://www.r-project.org)) was used to determine the DerSimonian & Laird<sup>1,2</sup> random effect summary statistic and 95% confidence interval of the country group-specific proportion of diarrhoea hospitalizations in which rotavirus was detected, figure 3.

Country group	Number of studies	Range	Random effect mean	95% CI
Very low child mortality (A)	14	20 - 54%	37.0%	28.7 - 45.2%
Low child mortality (B and C)	41	17 - 66%	40.1%	36.3 - 43.9%
High child mortality (D) the Americas <sup>3</sup>	1	16 - 52%	30.1%	24.9 - 35.2%
High child mortality (D and E) Africa	8	16-41%	29.5	24.4 - 34.6%
High child mortality (D) Asia	12	20-35%	25.7	22.0 - 29.3%
Total	76	16-66%	36.0%	33.0 - 40.0%

The country group-specific random effect means and 95% confidence intervals were applied to the 2004 country-specific estimates of under five diarrhoea deaths in that country group to estimate the number of child diarrhoea deaths attributable to rotavirus infection, figure 4. The global estimate of 2004 under five diarrhoea deaths attributable to rotavirus infection in 2004 was calculated to be 527 000<sup>4</sup> or 29% of all 2004 under five diarrhoea deaths.

<sup>1</sup> DerSimonian, R. & Laird, N.M. Meta-analysis in clinical trials. *Controlled Clinical Trials*: 7:177-188 (1986)

<sup>2</sup> Deeks, JJ; Altman, DG; Bradburn, MJ. Statistical methods for examining heterogeneity and combining results from several studies in meta-analysis, in Egger, M; Davey Smith, G; Altman, DG. *Systematic Reviews in Health Care: Meta-analysis in context*. BMJ Publishing Group, London, (2001)

<sup>3</sup> Only one study (Peru, 52%) was identified from high child mortality countries in the Americas. The estimate of the proportion of under five diarrhoea hospitalizations with rotavirus detected in this group was based on all studies conducted in D mortality strata countries.

<sup>4</sup> Actual calculated value is 527 347

The 95% confidence interval of 474 787 - 580 020 was derived based on the country group-specific random effect means and 95% confidence intervals above propagated through 10000 Monte Carlo runs<sup>5</sup>.

National estimates of rotavirus attributable deaths in 2004 among children under five years of age ranged from 122 270 (India) to fewer than 5 deaths (58 countries). Twenty-three percent of all rotavirus deaths under five years of age occurred in India and six countries (India, Nigeria, the Democratic Republic of the Congo, Ethiopia, China and Pakistan) accounted for more than half of all rota deaths under age five in 2004.

The cause-specific mortality rate (rotavirus deaths under age five per 100 000 population under age five) ranged from 439 (Sierra Leone) to less than 1 in 50 countries. Seven countries had an under five rotavirus mortality rate of greater than 300: Sierra Leone, Niger, Angola, Afghanistan, Liberia, Somalia and Mali.

Country group	< 5 years of age, 2004			
	Population < 5 years of age	Child deaths	Child diarrhoea deaths	Child rotavirus deaths
Very low child mortality (A)	52,427,605	62,392	147	53
Low child mortality (B and C)	225,861,793	1,473,305	188,004	75,407
High child mortality (D) the Americas <sup>6</sup>	9,542,848	98,368	14,283	4,291
High child mortality (D and E) Africa	137,877,505	4,914,427	854,902	251,783
High child mortality (D) Asia	188,047,719	3,758,545	762,671	195,813
Total	613,757,470	10,307,037	1,820,007	527,347

Country group	Proportion of total child rotavirus deaths	Rotavirus mortality rate (per 100 000 < 5 years of age)	Proportion of total child deaths	Proportion of total child diarrhoea deaths
Very low child mortality (A)	0%	0	0%	36%
Low child mortality (B and C)	14%	33	5%	40%
High child mortality (D) the Americas <sup>7</sup>	1%	45	4%	30%
High child mortality (D and E) Africa	48%	183	5%	29%
High child mortality (D) Asia	37%	104	5%	26%
Total	100%	86	5%	29%

<sup>5</sup>The external panel recommended using Monte Carlo methods to remain consistent with other child mortality estimation methods. Due to the simple nature of the current model, the Monte Carlo results could be easily verified using analytic methods which provide a 95% CI of 474 816 - 579 878.

Appreciation to Professor Peter Smith.

<sup>6</sup> Only one study (Peru, 52%) was identified from high child mortality countries in the Americas. The estimate of the proportion of under five diarrhoea hospitalizations with rotavirus detected in this group was based on all studies conducted in D mortality strata countries.

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Figure 1.

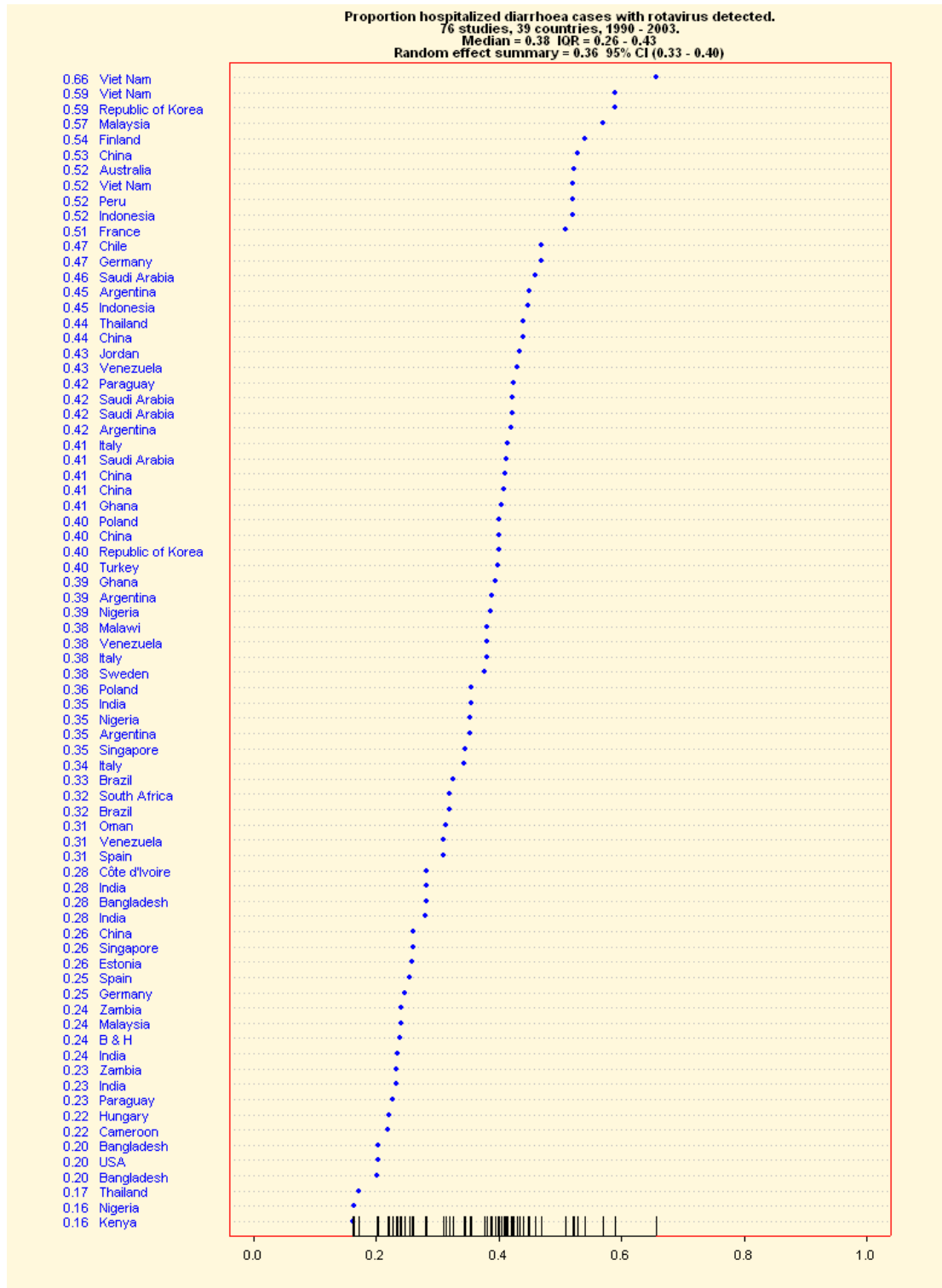


Figure 2.

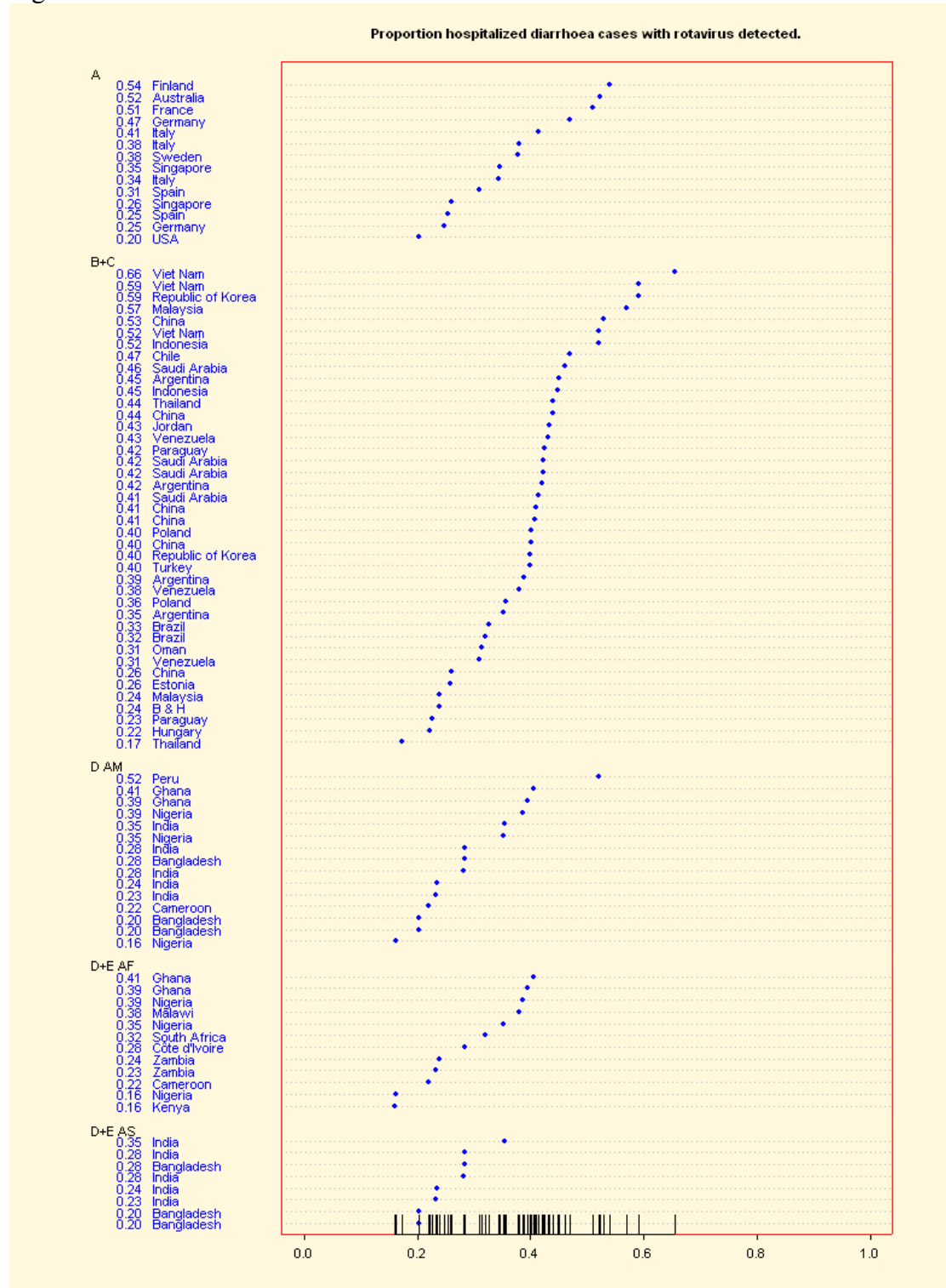


Figure 3.

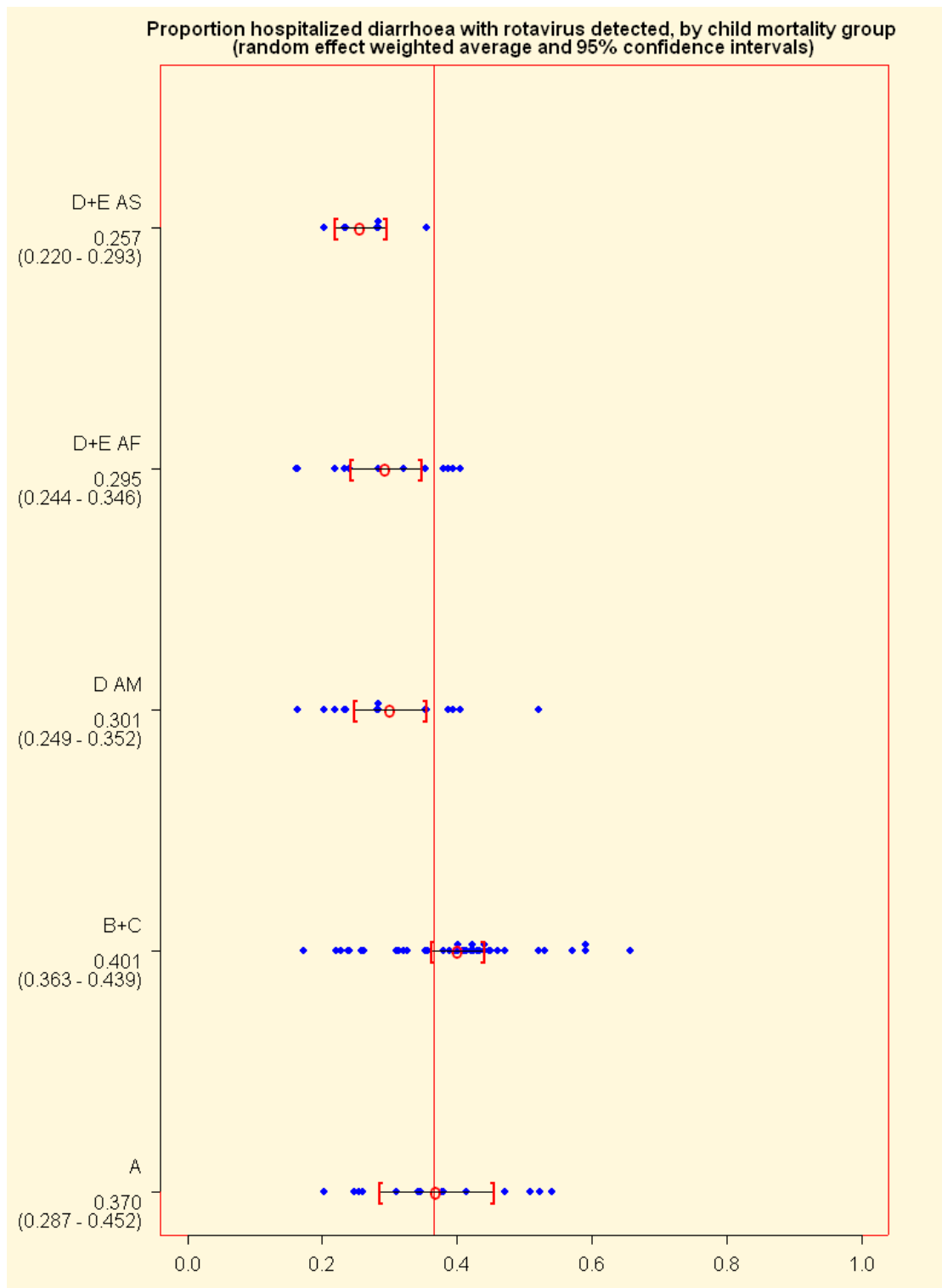


Figure 4.

