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Epidemiology of Rotavirus infection

Conservative estimates place the death toll from diarrhoeal diseases at four to six million deaths per year, with most deaths occurring in young children. In some developing countries, children have more than 12 episodes of diarrhoea per year and diarrhoeal diseases account for 15–34% of all deaths. The diversity of bacterial and viral infections that may cause diarrhoea complicates accurate surveillance and diagnosis, especially in developing countries with little or no access to modern laboratory procedures. The specific disease burden attributable to a particular infectious agent is especially complex, given the multiplicity of these agents and their serotypes, and depends largely on laboratory facilities. While, in the long term, access to clean water, better hygiene, adequate nutrition, and improvement of sanitary measures would certainly have the greatest impact on diarrhoeal diseases, immunizations against specific diseases are the best hope for the short and mid term. This is particularly true for viral diseases such as rotavirus, present in both high and low hygiene-level countries.

Public health impact of Rotavirus infection:

Rotavirus infection has a worldwide distribution, and is the most common cause of severe diarrhoea in young children. Almost all children are infected by the age of 3-5 years. More than 125 million cases of diarrhoea each year are attributed to rotavirus. It is estimated that rotavirus causes 25% of all deaths due to diarrhoeal disease, and 6% of all deaths in children aged < 5 years. The disease follows an incubation period of 1-2 days, and is characterized by acute onset of vomiting, fever and profuse watery diarrhoea. Although the infection is usually mild, severe disease may rapidly result in life-threatening dehydration if not appropriately treated. The greatest disease burden is in developing countries, where 20%-40% of annual hospitalizations for childhood diarrhoea, and about 600 000 deaths each year, are associated with this infection.

In developing countries most cases of severe rotavirus disease occur in infants whereas in the industrialized world the majority of severe cases occur beyond the first year of life. In Australia, England and Wales, Japan and the United States, rotavirus infection is shown to be responsible for 34%-52% of hospitalizations for childhood gastroenteritis, but mortality from rotavirus diarrhoea is extremely rare in these countries.

In tropical developing countries, rotavirus disease occurs throughout the year. Several viral serotypes may operate simultaneously in the same geographical area, and infection with more than one strain in individual patients is common. In industrialized countries in temperate climates, rotavirus infections peak during the winter season and mixed infections are uncommon.

Rotavirus is transmitted by the faecal-oral route and a small inoculum may cause infection. Animal reservoirs for human rotavirus infection are not known to exist, and asymptomatic human carriers do not seem be a major source of sporadic cases. Rotavirus may cause hospital infections in children, and are associated with diarrhoea in travellers, the elderly and careers of small children.

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The pathogen :

Rotaviruses belong to the Reoviridae family and are 70 nm, non-enveloped viruses with 11 segments of doublestranded RNA. Groups are specified by inner capsid antigen and only group A is an important cause of disease in children. The 2 structural proteins of the outer capsid, the VP7 glycoprotein (or G protein) and the VP4 proteasecleaved protein (or P protein) define the serotypes of the virus against which neutralizing antibodies are derived. Worldwide, G1-G4 are the serotypes most commonly linked to rotavirus diarrhoea, although additional serotypes appear to play a role in some settings. Cross-reactivity between human and several animal rotavirus antigens has been recorded and occasionally, rotavirus strains isolated from humans are shown to be reassortants between human and animal strains. However, it is unlikely that this phenomenon has had a significant impact on the natural history of rotavirus infection or disease, and humans appear to be the only reservoir of human strains. Rotavirus is not inhibited by existing antiviral drugs.

Simple and inexpensive immunoassays are available for detection of rotavirus in the stool.

Protective immune response:

The immune correlates of protection to rotavirus infection are not well defined. Neutralizing antibodies to the 2 outer capsid antigens VP7 and VP4, and IgG or IgA antibodies to the inner capsid antigen, VP6, have each been correlated with protective immunity by some investigators. A rotavirus-specific IgA response to VP6 is believed to be essential for protective immunity in the intestinal mucosa. It is likely that cell-mediated immunity is related to clearing infection. Immunogenicity of rotavirus vaccines is usually measured by serum IgA sero conversion or by level of neutralizing antibodies to the vaccine strain. A child's first rotavirus infection results in a serotype specific immune response, which is broadened upon subsequent exposures. Immunity acquired during these first infections protects against severe disease on subsequent exposures to rotavirus of different serotypes. Breastfeeding may provide some protection against the disease in the very young infants. Symptomatic rotavirus infection occurs primarily in the first 2-3 years of life, during which time most children worldwide develop immunity to rotavirus diarrhoea.

The justification for vaccine control:

Rotavirus diarrhoea represents an important global public health problem, and the accelerated development and introduction of rota virus vaccines have been given high priority by WHO and other stakeholders. As the incidence of rotavirus diarrhoea does not differ dramatically between developing and developed countries, it is unlikely that environmental improvements will have a great impact on the disease incidence, although mortality due to rotavirus decreases with improvement in standard of living. Oral rehydration is the treatment of choice and can be life-saving, but does not reduce dissemination of the virus. Specific antirotavirus chemotherapy is currently not available. Natural immunity has been demonstrated by the immunity conferred by 1 or several natural infections, and a decade of experience with different candidate vaccines clearly supports the concept of immune prophylaxis through vaccination. In industrialized countries, experimental oral rotavirus vaccines have shown a protective efficacy of 80% or more against severe disease. Except for mild to moderate fever in about 20% of the vaccinees on day 4, there have been minimal adverse reactions following vaccination, and cost-effectiveness studies indicate that, depending upon the price, a rotavirus vaccine could be cost-effective.

WHO position on rotavirus vaccines:

The WHO steering committee on diarrhoeal disease vaccines

maintains rotavirus vaccine development as its first priority. Although WHO encourages worldwide introduction of rotavirus vaccines, emphasis is on countries with the highest disease burden. However, because of differences in epidemiology, health priorities and economic capacity, rotavirus vaccines will be introduced at different rates into national immunization programmes. The background information presented above shows that rotavirus disease is a considerable medical and socioeconomic problem worldwide. Ample evidence shows that currently available vaccines provide efficient protection against severe rotavirus disease in children aged < 2 years in industrialized countries. Similar encouraging results have been obtained in limited number of trials conducted in different patrts of the world. The Rota virus vaccine is safe, and easily adapted to national childhood immunization programmes. Oral administration is important from the logistic point of view. So far, no lasting substantial interference with simultaneously administered vaccines has been reported. Introduction into industrialized countries of safe and efficacious rotavirus vaccines should be welcomed as an important first step towards global control.

Before rotavirus vaccines may be recommended for large-scale immunization in developing countries, it is essential that protective efficacy be documented in developing country settings. Hence, efficacy studies are strongly encouraged, particularly in Africa and Asia. If affordable prices for the vaccines can be achieved, rotavirus immunization is likely to be given high priority in all areas where rotavirus infection is recognized as a public health problem.

Source:

Weekly Epidemiological Record, World Health Organization No. 5, 1999;74,33 - 40.

[http://www.who.int/wer]

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Table 1: Vaccine-preventable Diseases & AFP

5th - 11th Jan 2008 (2ndWeek)

Disease	No. of Cases by Province									Number of cases during current week in 2008	Number of cases during same week in 2007	Total number of cases to date in 2008	Total number of cases to date in 2007	Difference between the number of cases to date between 2008 & 2007
	W	C	S	N	E	NW	NC	U	Sab					
Acute Flaccid Paralysis	01 GM=1	00	00	00	00	00	00	00	00	01	02	05	02	+150.0%
Diphtheria	00	00	00	00	00	00	00	00	00	00	00	00	00	00.0%
Measles	01	01	00	00	00	01	00	00	00	03	00	03	00	+300.0%
Tetanus	00	00	00	00	00	00	00	00	00	00	01	01	01	00.0%
Whooping Cough	00	00	00	00	00	00	00	00	00	00	00	00	00	00.0%
Tuberculo-sis	120	15	04	02	54	12	03	16	18	244	272	555	434	+27.9`%

5th - 11th Jan 2008 (2ndWeek)

Table 2: Newly Introduced Notifiable Diseases

Disease	No. of Cases by Province									Number of cases during current week in 2008	Number of cases during same week in 2007	Total number of cases to date in 2008	Total number of cases to date in 2007	Difference between the number of cases to date between 2008 & 2007
	W	C	S	N	E	NW	NC	U	Sab					
Chicken-pox	22	05	15	00	03	05	02	11	05	68	48	155	54	+187.0%
Meningitis	06 GM=4 KL=1 CO=1	00	10 GL=6 MT=2 HB=2	00	02 AM=1 TR=1	05 KU=5	03 PO=3	05 MO=3 BD=2	14 RP=7 KG=7	45	09	70	19	+268.4%
Mumps	15	03	06	00	09	07	01	04	07	52	08	91	09	+911.0%

Key to Table 1 & 2

Provinces: W=Western, C=Central, S=Southern, N=North, E= East, NC=North Central, NW=North Western, U=Uva, Sab=Sabaragamuwa.

DPDHS Divisions: CB=Colombo, GM=Gampaha, KL=Kalutara, KD=Kandy, ML=Matale, NE=Nuwara Eliya, GL=Galle, HB=Hambantota, MT=Matara, JF=Jaffna, KN=Killinochchi, MN=Mannar, VA=Vavuniya, MU=Mullaitivu, BT=Batticaloa, AM=Ampara, TR=Trincomalee, KM=Kalmunai, KR=Kurunegala, PU=Puttalam, AP=Anuradhapura, PO=Polonnaruwa, BD=Badulla, MO=Moneragala, RP=Ratnapura, KG=Kegalle.

Table 3: Laboratory Surveillance of Dengue Fever

5th - 11th Jan 2008 (2ndWeek)

Samples	Number tested	Number positive *	Serotypes				
			D_1	D_2	D_3	D_4	Negative
Number for current week	04	00	00	00	00	00	00
Total number to date in 2008	06	00	00	00	00	00	00

Source: Genetech Molecular Diagnostics & School of Gene Technology, Colombo. * Not all positives are subjected to serotyping.

NA= Not Available.

Data Sources:

Weekly Return of Communicable Diseases: Diphtheria, Measles, Tetanus, Whooping Cough, Human Rabies, Dengue Haemorrhagic Fever, Japanese Encephali - tis, Chickenpox, Meningitis, Mumps.

Special Surveillance: Acute Flaccid Paralysis.

Table 4: Selected notifiable diseases reported by Medical Officers of Health

5th - 11th Jan 2008 (2nd Week)

DPDHS Division	Dengue Fever / DHF*		Dysentery		Encephal-itis		Enteric Fever		Food Poisoning		Leptos-pirosis		Typhus Fever		Viral Hepatitis		Human-Rabies		Returns Re-ceived Timely**
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	%
Colombo	44	93	03	08	01	01	03	08	03	03	01	05	00	00	04	04	00	00	**100**
Gampaha	24	71	00	00	00	00	02	03	00	00	02	07	00	00	00	02	00	00	**79**
Kalutara	05	18	02	06	00	00	01	02	00	00	04	07	00	00	03	03	00	00	**100**
Kandy	04	11	05	10	00	00	01	02	00	02	04	11	00	01	03	08	00	00	**75**
Matale	01	04	01	06	00	00	02	03	00	00	13	22	00	00	00	01	00	00	**42**
Nuwara Eliya	00	00	00	01	00	00	02	02	00	00	00	01	00	01	00	04	00	00	**67**
Galle	06	12	06	09	00	00	02	03	00	00	09	27	00	01	01	01	00	00	**88**
Hambantota	01	02	03	08	00	00	00	01	00	00	01	02	04	04	00	00	00	00	**91**
Matara	06	16	06	09	00	00	01	10	00	00	06	08	05	09	00	00	00	01	**100**
Jaffna	00	00	00	00	00	00	00	00	00	00	00	00	02	02	01	01	00	00	**25**
Kilinochchi	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	01	00	00	**25**
Mannar	00	00	00	00	00	00	04	11	00	00	00	00	00	00	01	01	00	00	**50**
Vavuniya	00	03	01	04	00	00	00	00	00	00	00	00	00	00	00	00	00	00	**50**
Mullaitivu	00	00	00	00	00	00	00	01	00	00	00	00	00	00	00	01	00	00	**60**
Batticaloa	00	00	01	03	00	00	00	00	00	00	00	00	00	00	02	05	00	00	**45**
Ampara	00	00	07	12	00	00	00	00	00	00	00	01	00	00	00	00	00	00	**57**
Trincomalee	02	03	00	03	00	00	00	00	00	01	00	00	00	00	01	01	00	00	**67**
Kurunegala	15	31	20	38	02	02	02	03	00	00	00	01	02	02	00	02	00	00	**83**
Puttalam	05	20	02	09	00	00	00	02	00	01	00	01	00	00	00	01	00	00	**56**
Anuradhapur	03	19	05	05	00	01	00	01	00	02	00	00	00	02	00	00	00	00	**58**
Polonnaruwa	04	08	05	08	00	00	00	00	00	00	00	00	00	00	00	02	00	00	**100**
Badulla	03	05	17	19	00	00	03	05	00	00	02	03	04	05	04	05	00	00	**80**
Monaragala	01	01	03	14	00	00	00	00	03	03	06	07	04	05	01	01	00	00	**90**
Ratnapura	05	12	03	11	01	01	00	02	00	41	02	02	01	01	01	01	00	00	**63**
Kegalle	07	17	09	18	03	04	01	01	00	00	02	07	00	00	01	05	00	00	**82**
Kalmunai	00	00	02	02	00	00	00	00	00	00	00	00	00	00	00	01	00	00	**54**
SRI LANKA	**136**	**346**	**101**	**203**	**07**	**09**	**24**	**60**	**06**	**53**	**52**	**112**	**22**	**33**	**23**	**51**	**00**	**01**	**72**

Source: Weekly Returns of Communicable Diseases (WRCD).
***Dengue Fever / DHF** refers to Dengue Fever / Dengue Haemorrhagic Fever.
****Timely** refers to returns received on or before 19 January. 2008 Total number of reporting units =290. Number of reporting units data provided for the current week: 238

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