

# PROSPECTIVE STUDY OF DIARRHEA IN INFANTS AND YOUNG CHILDREN OF A PERI-URBAN PHILIPPINE COMMUNITY : MORBIDITY PATTERNS AND ETIOLOGIES

Mediadora C. Saniel

*The Research Institute for Tropical Medicine, Ministry of Health, Alabang,  
Muntinlupa, Metro Manila, Philippines*

## ABSTRACT

In the peri-urban community of Alabang, morbidity and mortality due to diarrhea in 453 children less than five years of age, as well as associated bacterial and viral agents, were monitored by twice weekly household visits from July 1982 to July 1984. Overall incidence was low at six episodes per 100 child-months or 0.8 episode per child per year, with peak periods occurring during the rainy season and during the cool dry months of January and February. Diarrhea attack rates were highest at six to 11 months of age among the children of the poorest families. An enteropathogen was identified from rectal swabs taken during diarrhea in 35% of episodes and from 23% of cultures taken from asymptomatic matched controls. *Salmonella* (10.1%), ETEC (9.4%), rotavirus (71.1%), EPEC (6.4%), and *Shigella* (4.1%) were the five most frequently isolated pathogens in association with episodes. However, only with rotavirus, *Shigella* and EPEC was a significant difference in isolation rate between cases and controls observed.

## Introduction

Diarrheal disease is a leading cause of death among children in countries of the Western Pacific region, with an estimated mortality rate of 1.5 per 1000 and morbidity rate of 1.8 episodes per child per year (1). Among children below five years in the Philippines, it ranks second as a cause of death and illness and third among the leading causes of infant deaths (2).

We undertook a two-year longitudinal study of diarrhea in children of a peri-urban community to determine etiologies and patterns of disease. Before this study, there had been no prospective diarrheal disease morbidity and mortality surveys in the urban and peri-urban regions of the Philippines.

## Materials and Methods

The study was conducted in Alabang, a peri-urban community located ~20 km south of Manila. The population in 1982 was over 32,000 of which children less than five years of age accounted for 20%. To determine attack rates and sea-

sonal patterns of diarrheal illness in different socioeconomic conditions, 442 households belonging to the upper (12%), middle (44%) and low (44%) income groups were selected by a multi-stage stratified cluster sampling method. From June 1982 to July 1984, surveillance workers visited every household twice a week and obtained clinical information and rectal swabs from each child less than five years old with diarrhea. For every diarrheal episode, rectal swabs were likewise collected from an asymptomatic child matched according to age, sex and socioeconomic status.

Specimens were transported in Cary-Blair media and cultured for salmonellae, shigellae, vibrios, *Campylobacter* and *Y. enterocolitica* using standard methods (3). Procedures for identifying enterotoxigenic (ETEC), enteropathogenic (EPEC) and invasive *E. coli* (EIEC) were previously described (4). For rotavirus antigen detection, an ELISA using reagents provided by the World Health Organization Collaborating Centre for Reference and Research on Rotaviruses, Birmingham, England was performed.

Morbidity records were punched onto cards for editing and analysis using the Biomedical Computer Programs (BMD). Incidence rates were calculated using the number of months at risk as determined by surveillance. Statistical comparisons were done with chi-square, Oleinick-Mantel chi and z tests as appropriate.

## Results

Surveillance during the 26-month period revealed striking patterns of diarrhea incidence rates among the 453 children studied. During the 10,936 person-months (911 person-years) of surveillance, 697 episodes of diarrhea occurred. Diarrheal illness rates (overall, 0.8 per person-year) significantly increased from three to more than seven episodes per 100 person-months (0.4 to 0.9 per person-year) as the socioeconomic condition deteriorated ( $P < 0.001$ , upper vs. middle;  $P < 0.01$ , middle vs. low). The age-specific attack rates peaked in the six-to-11-month-old age group in households in all three socioeconomic levels, with the number of episodes exceeding 18 per 100 person-months (2.2 per person-year) in this age group among the poor families.

From July 1982 to July 1984, rectal swabs of 556 (88%) of the 633 cases of diarrheal illness were tested for enteric pathogens. A recognized agent was identified in 35% of these, with *Salmonella* isolated most frequently in 56 (10.1%) cases (Table 1). Enterotoxigenic *E. coli* were detected in 52 (9.4%) specimens, with LT-producing coliforms predominating (6.1%). Next in frequency were rotaviruses (7.1%), EPEC (6.4%), *Shigella* (4.1%), *C. jejuni* (2.0%), and *V. cholerae* 01 (0.5%). *Y. enterocolitica* and invasive *E. coli* were not isolated. Mixed infections were seen in 3.6%.

In children less than two years old, ETEC (10.9%) followed by *Salmonella* (9.9%) and rotavirus (7.8%) were the most frequently identified enteropathogens. Ninety-five percent of rotavirus diarrhea occurred in children 3-35 months of age

with a peak incidence in the second six months of life. Approximately 80% of episodes associated with *Shigella* were observed in children over a year old.

Twenty-three percent of cultures from asymptomatic children yielded enteropathogens. Infections with rotavirus, EPEC and *Shigella* were significantly associated with episodes when compared with their identification from controls (Table 1).

Table 1. Enteric pathogens in children < 5 years with diarrhea and controls

Pathogen	Diarrhea n = 556		Control n = 479		P
	No.	%	No.	%	
Salmonella	56	10.1	42	8.8	NS*
ETEC	52	9.4	36	7.5	NS
Rotavirus	39	7.1	3	0.6	<0.001
EPEC**	20	6.4	9	3.1	<0.05
Shigella	23	4.1	14	2.5	<0.05
Campylobacter	11	2.0	10	2.1	NS
<i>Vibrio cholerae</i>	3	0.5	0		NS

\*Not significant

\*\*311 and 291 specimens were tested from cases < 3 years and controls, respectively.

Pathogen-specific attack rates were similar in all three socioeconomic groups, except for ETEC diarrhea which was significantly more frequent in symptomatic children from poor families than in all other children with diarrhea (0.7 vs. 0.2 per 100 person-months;  $P < 0.05$ ). Although cultures from control children of the upper income group were less likely to yield enteropathogens than those from all other asymptomatic children, the difference did not approach statistical significance.

The seasonal pattern of diarrhea as illustrated in Fig. 1 showed two peaks, the first occurring during the rainy season from June to September and the other during the dry, slightly cooler months of January and February. For infections with specific pathogens, no consistent seasonal pattern could be determined.

More than 90% of episodes presented with no or mild dehydration. The median duration was two to three days and was not related to etiologic agent or socio-economic status. There was no mortality from diarrhea.

### Discussion

This is the first prospective study of diarrhea morbidity and etiologic agents in a peri-urban setting in the Philippines. The attack rate of diarrheal illness among

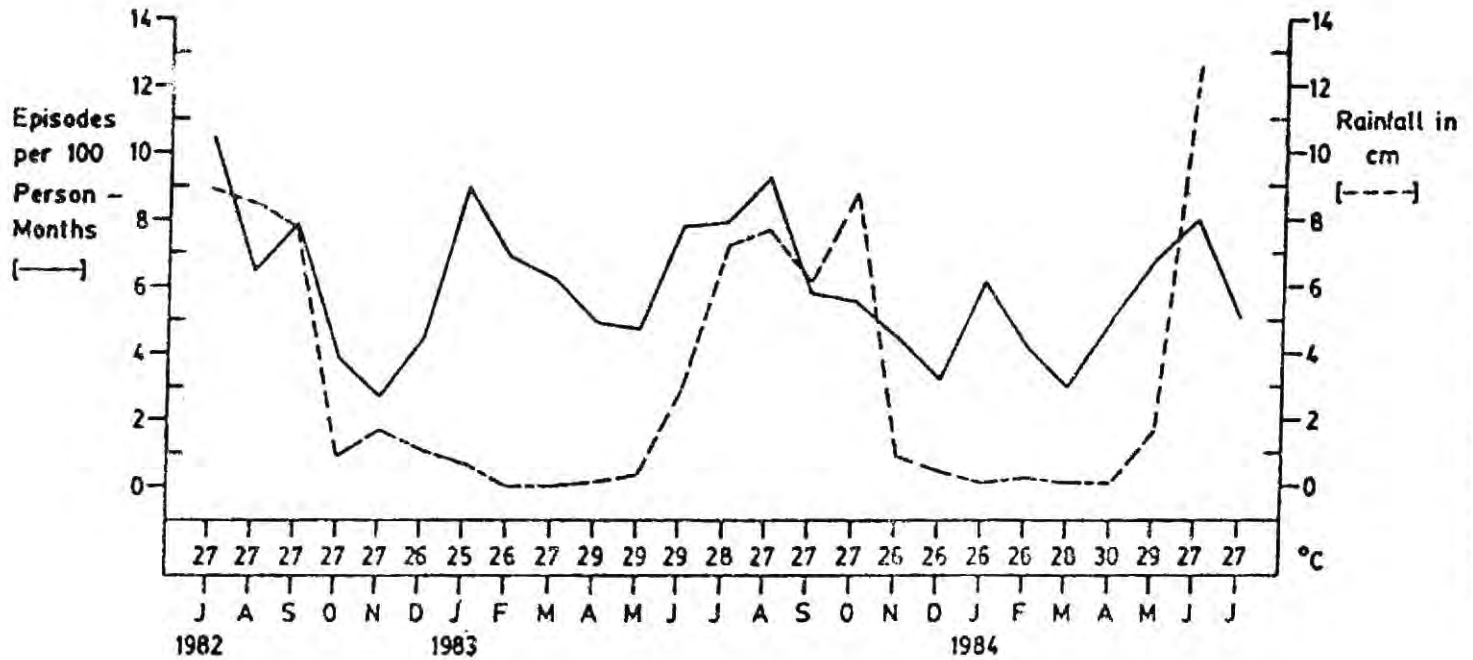


Fig. 1. Seasonal incidence of diarrheal episodes, mean monthly temperature and rainfall from July 1982 through July 1984.

young children is lower than what has been found in other developing tropical countries (5, 6, 7) and in a rural Philippine community (8). The observed difference in illness rates among children in different socioeconomic conditions is most likely due to a number of host, behavioral and environmental factors. Attempts to identify possible risk factors as early weaning, severe malnutrition, contaminated water supply and poor sanitation are ongoing and should help focus the attention of concerned agencies on specific intervention measures.

The relative importance of different enteropathogens as presented is similar to other studies (5, 9, 10), except for the predominance of LT-producing *E. coli* among ETEC isolates and the frequency of isolating salmonellae in stools of both children with and without diarrhea in this study. Once again EPEC serotypes are documented as important causes of diarrhea. The consistent finding of rotavirus as a significant pathogen in this and most other studies underscores the potential role of rotavirus vaccine in diarrheal disease control.

Similar longitudinal studies in rural areas have to be done for a more complete picture of the epidemiology of diarrhea in the Philippines.

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