

An Extensive Community Outbreak of Enteropathogenic *Escherichia coli* O₈₆: B₇ Gastroenteritis *

S. C. PAL, C. KOTESWARA RAO, T. KERESLIDZE,¹ A. K. KRISHNASWAMI,
D. K. MURTY,² C. G. PANDIT³ & J. B. SHRIVASTAV⁴

During the last 20 years numerous reports of hospital-associated epidemics of enteropathogenic Escherichia coli (EEC) gastroenteritis have appeared in the medical literature. Some of the reports suggest that EEC gastroenteritis can also be a community problem. However, community epidemics of EEC gastroenteritis comparable to those of other communicable diseases like cholera or typhoid are rare.

An extensive epidemic of acute gastroenteritis occurred among children in Surat, Gujarat State, India, between 29 October and 3 December 1965. A total of 418 patients was hospitalized during this period: 344 of them were under 2 years of age. Faecal specimens from 81 children admitted between 25 November and 30 November were subjected to microbiological examination. Of these samples, 34 yielded pure cultures of E. coli O₈₆:B₇ and 1 yielded a pure culture of O₁₂₆:B₁₆. The cases occurred throughout the town including a rural ward. The morbidity rate for the total population was 0.16% and the age-specific morbidity rate for the 0-2-years age-group, was 0.98%; the highest morbidity rate (2.4%) was in the 6-11-months age-group in the urban wards. No definite mode of transmission of the disease could be established.

Certain serotypes of *Escherichia coli* are now accepted as being the etiological agents of acute gastroenteritis in infants (Taylor, 1960). The gathering of infants of this highly susceptible age-group in closed communities like nurseries and hospital wards has focussed attention on institutional epidemics. Numerous hospital-associated epidemics of gastroenteritis due to infections with enteropathogenic *Escherichia coli* (EEC) have been reported during the last 20 years (Giles & Sangster, 1948; Kirby, Hall & Coackley, 1950; Rogers, 1951; Neter,

Korns & Trussell, 1953; Anderson, Crockatt & Ross, 1954; Harris et al., 1956; Hinton & MacGregor, 1958; Cooper et al., 1959), but only a few reports on community outbreaks of EEC gastroenteritis are available.

An epidemic of acute gastroenteritis among children broke out in Surat, Gujarat State, India, during November 1965 and was investigated by a team from the National Institute of Communicable Diseases, Delhi. The results of the epidemiological and microbiological investigations carried out are presented in this communication.

* From the National Institute of Communicable Diseases, Delhi 6, India.

¹ Present address: Communicable Diseases Division, World Health Organization, Geneva, Switzerland.

² Present address: Disease Investigation Officer, Uttar Pradesh College of Veterinary Science and Animal Husbandry, Mathura, Uttar Pradesh, India.

³ Present address: Honorary Consultant, Post-Graduate Institute of Medical Education and Research, Chandigarh, India.

⁴ Present address: Additional Director-General of Health Services, Nirman Bhavan, New Delhi-11, India.

TOPOGRAPHY

Surat is an industrial town with a population of about 300 000 and is situated on the west coast of India. The town has an area of 9 mi² (23 km²), and is divided arbitrarily into 13 wards for administrative purposes. Wards 1-12 are purely urban but ward 13 is mainly rural, consisting of 2 villages adjoining the

town. The river Tapti runs from east to west dividing the town into 2 parts.

Water and milk supply

The people residing in the 12 urban wards of the town use water from the municipal water works which draws water from the bed of the adjoining river Tapti about 13 miles (ca 20 km) upstream from the town. The water is chlorinated at the water works by Patterson's Chloronome but the chlorine pressure is not properly regulated for adequate chlorination of water throughout the day nor are there any arrangements for routine bacteriological examination of the raw and the treated water. Ward 13, which is mainly rural, depends on draw-wells and to a small extent on the municipal water supply for drinking water.

The milk supply for the town comes from the nearby villages and is distributed by vendors without any prior treatment. It is customary to boil the milk before consumption. The standards of hygiene of most food establishments and of the milk vendors were far from satisfactory.

Sewage disposal

The latrines of about 50% of the houses are connected to a proper underground sewage disposal system and the remainder in the 12 urban wards are provided with service-type latrines. Ward 13 has no latrines and open fields are used for defaecation. Regular anti-mosquito measures are applied to the open drains in the urban wards.

During the period under study, flies were not a great nuisance, but it was reported that this was the period of minimum fly density.

Medical and health facilities

There are 4 hospitals in Surat with a total of about 450 beds. Besides these hospital facilities, there are 14 private nursing homes and about 100 registered medical practitioners. Gastroenteritis cases are admitted only in the Musket Charitable Municipal Hospital. As no facilities for bacteriological examination were available at this hospital, the specimens were sent to the municipal public health laboratory.

Outbreaks of cholera were reported in the years 1964 and 1965 from the Surat municipal area and the total number of cases recorded was 739 and 801, respectively. However, no cases of cholera were reported during October and November in either of these years.

MATERIALS AND METHODS

Data for the clinical and epidemiological investigations were collected from the following sources:

- (1) Case records of 534 hospitalized cases of gastroenteritis between 1 October and 3 December 1965;
- (2) House visits to 90 cases, hospitalized between 24 and 30 November 1965;
- (3) A sample survey conducted from 1 December to 3 December to estimate the morbidity and mortality among different age-groups and sexes and to estimate the ratio of hospitalized to non-hospitalized cases in ward no. 4. A total of 332 families, with 2567 members, was examined.

Ward 4 was selected for the survey as it includes most of the socio-economic groups in the population. The houses in this ward were numbered consecutively by the municipal authority so that it was convenient to sample every 20th house, from a random starting-point, to cover 5% of the houses.

Microbiological investigations

The following specimens were collected for microbiological investigations:

Stool samples. These were collected from 81 children suffering from gastroenteritis and who had been admitted to hospital. The samples were collected in triplicate from each patient with the help of sterile rubber tubing. The samples were collected in:

- (1) Venkatraman & Ramakrishnan's (VR) holding fluid for the isolation of cholera vibrios;
- (2) Hanks' solution (with 100 IU of penicillin and 100 μ g of streptomycin per ml) for virus isolation. These samples were kept in an ice-chamber and were brought back to the laboratory in an ice-box;
- (3) sterile bottles for isolation of other intestinal pathogens.

Vomit. Samples of vomitus were collected in sterile bottles and in VR fluid from 2 patients.

Rectal swabs. Rectal swabs were collected to determine the carrier status for EEC:

- (a) from 20 healthy mothers, attending their children in the hospital;
- (b) from healthy members of 6 families with cases of gastroenteritis;
- (c) from 12 members of 3 families without any case of gastroenteritis.

Water samples. Five samples of filtered water from the municipal water supply were collected from a storage tank and from different distribution points for bacteriological analysis. One sample of raw water was also collected from the river bed.

Milk samples. Six samples of milk were collected from different families: the milk, which was to be used for feeding infants had been kept after boiling.

The preliminary bacteriological examination was performed at the Public Health Laboratory, Surat, and further examinations were made at the laboratory of the National Institute of Communicable Diseases.

Culture techniques. Samples of stools and vomit were inoculated on MacConkey's bile-salt agar, desoxycholate citrate agar (DCA) and on blood-agar plates. After overnight incubation at 37°C most of the MacConkey and blood-agar plates showed pure growths of *E. coli*. These *E. coli* strains were tested with enteropathogenic *E. coli* antisera (pools A and B). A number of strains gave positive slide agglutination with pool B. These strains were further tested with individual OB antisera. The results of slide agglutination were further confirmed by tube agglutination tests with specific antisera.

Stool samples collected in VR fluid were cultured in alkaline peptone water at pH 9.2, and after 6-8 hours' incubation were subcultured on bile-salt-agar media.

Water samples were analysed for the presumptive coliform count and total count.

For the milk samples, 0.1 ml was spread on the surface of MacConkey and blood-agar plates with the help of bent Pasteur pipettes and the plates were incubated overnight at 37°C.

The stool samples collected in Hanks' solution were handed over to the All India Institute of Medical Sciences, New Delhi, for virus isolation.

RESULTS

Symptoms ranged from a few loose stools with no dehydration to severe dehydration due to frequent vomiting and diarrhoea. The colour of the stools was greenish at the beginning and became watery during the later stage and they contained no blood or mucus. A rise in body temperature was recorded at the time of admission in 14 out of 388 patients under 3 years of age. Most of the patients had received chloramphenicol before admission.

Out of 81 faecal samples collected from the patients, 11 samples showed no growth except a few colonies of aerobic spore-bearing organisms and of *Streptococcus faecalis*. The remaining 70 samples yielded growth of *E. coli* either in pure culture or with colonies of *Streptococcus faecalis*. Of these 70 cultures of *E. coli*, 34 were of serotype O₈₈:B, and 1 was of serotype O₁₂₆:B₁₆. No *Vibrio cholerae* or other pathogens were isolated.

Enteropathogenic *E. coli* serotype O₈₈:B, was also isolated from 3 out of 20 faecal samples collected from mothers attending their children in hospital but it was not found in any of the specimens collected from family members.

The virus strain Echo 29 was isolated from only 1 specimen out of 81 faecal samples in primary monkey kidney cell culture.

No coliform organisms were present in the filtered water samples. Water collected from the river bed showed a large number of *E. coli*, *Aerobacter aerogenes* and other contaminants. However, no enteropathogenic *E. coli* were present.

No pathogens were isolated from vomitus.

Among the milk samples 3 out of 6 gave heavy growth of *Aerobacter aerogenes* and other contaminants.

The age distribution of the hospitalized cases of gastroenteritis and deaths for the period 1 October-3 December 1965 is shown in Table 1. The results of investigation of the hospitalized cases showed that the epidemic began around 29 October, with a peak between 14 November and 21 November, and declined to the pre-epidemic level by 4 December. The case-fatality rate was 8.2% in the 0-2-years age-group and 5.5% in the 3-years-and-over age-group.

Morbidity and mortality rates by age-group and by sex of hospitalized cases for the period 1 October-3 December are presented in Table 2 for the urban (1-12) and rural (13) wards.

Of the 534 cases hospitalized, 388 (72.7%) were in the 0-2-years age-group and 146 (27.3%) in the 3-years-and-over age-group. These numbers when applied to the estimated population give a rate of 0.98% and 0.05% among the 0-2-years and 3-years-and-over age-groups respectively.

Of the 388 patients in the 0-2 years age-group, 258 (66.5%) were boys and 130 (33.5%) were girls. The morbidity rate according to sex in this age-group was 1.27% for boys and 0.67% for girls. There was no sex difference in the 3-years-and-over age-group. The morbidity rate in the 0-2-years age-

TABLE 1

NUMBERS OF HOSPITALIZED CASES OF EEC GASTRO-ENTERITIS, AND THE NUMBER OF DEATHS, BY AGE-GROUP IN SURAT DURING OCTOBER AND NOVEMBER 1965

Period	0-2-years age-group		≥3-years age-group		Total	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
1-4 Oct.	6	1	12	0	18	1
5-8 Oct.	8	1	10	1	18	2
9-12 Oct.	6	0	7	0	13	0
13-16 Oct.	6	1	9	3	15	4
17-20 Oct.	3	0	10	0	13	0
21-24 Oct.	6	0	5	0	11	0
25-28 Oct.	9	2	19	1	28	3
29 Oct.-1 Nov.	20	3	9	1	29	4
2-5 Nov.	34	1	7	1	41	2
6-9 Nov.	43	5	8	0	51	5
10-13 Nov.	49	7	12	1	61	8
14-17 Nov.	55	6	14	0	69	6
18-21 Nov.	59	3	8	0	67	3
22-25 Nov.	43	1	6	0	49	1
26-29 Nov.	27	1	9	0	36	1
30 Nov.-3 Dec.	14	0	1	0	15	0
Total	388	32 (8.2%)	146	8 (5.5%)	534	40 (7.5%)

group was 1.0% in the urban wards (1-12) and 0.71% in the rural (13) ward.

Breakdown of the number of cases and deaths, and the morbidity, mortality and case-fatality rates among children from 0 to 2 years of age, for the urban (1-12) and rural (13) wards are given in Table 3. As the epidemic was largely confined to the 0-2-years age-group further analysis was limited to this age-group. Over 90% of the cases in the 0-2-years age-group occurred among children of 6-23 months in both urban and rural wards. Morbidity and mortality rates were high in the 6-23-months age-group in both areas. The case-fatality rate was high in the 6-11-months age-group in urban wards and in the 6-11-months and 12-23-months age-groups in the rural wards. The case-fatality rate in the rural ward was about 3 times greater than in the urban wards.

TABLE 2

MORBIDITY AND MORTALITY OF HOSPITALIZED CASES BY AGE AND BY SEX FOR THE PERIOD 1 OCTOBER-3 DECEMBER IN THE URBAN (1-12) AND RURAL (13) WARDS OF SURAT

Sex	No. of cases (No./100 population in parentheses)			No. of deaths (No./10 000 population in parentheses)		
	Wards 1-12	Ward 13	Total	Wards 1-12	Ward 13	Total
0-2-years age-group						
Male	249 (1.31)	9 (0.69)	258 (1.27)	15 (7.9)	1 (7.7)	16 (7.9)
Female	121 (0.67)	9 (0.73)	130 (0.67)	13 (7.2)	3 (24.4)	16 (8.3)
Total	370 (1.0)	18 (0.71)	388 (0.98)	28 (7.6)	4 (5.8)	32 (8.1)
≥3-years age-group						
Male	64 (0.04)	5 (0.04)	69 (0.04)	6 (0.4)	1 (0.8)	7 (0.4)
Female	73 (0.05)	4 (0.04)	77 (0.05)	1 (0.1)	—	1 (0.1)
Total	137 (0.05)	9 (0.04)	146 (0.05)	7 (0.3)	1 (0.4)	8 (0.3)
All ages						
Male	313 (0.19)	14 (0.10)	327 (0.18)	21 (1.2)	2 (1.5)	23 (1.3)
Female	194 (0.13)	13 (0.10)	207 (0.13)	14 (0.9)	3 (2.4)	17 (1.0)
Total	507 (0.16)	27 (0.10)	534 (0.16)	35 (1.1)	5 (1.9)	40 (1.2)

The distribution of 388 cases among children of 0-2 years of age, according to the city wards, is shown in Table 4. Cases were distributed in all the wards. A comparison was made between ward no. 13 and the rest, as the water supply to this ward was mostly from draw-wells, while that to the other wards was from the municipal water supply. The morbidity rate for the wards 1-12 was 1.0% while for ward 13 it was 0.7%. The case-fatality rate for all children in this age-group was 8.2% while for urban wards (1-12) it was 7.6% and for the rural ward (13) it was 22.2%. The mortality rates in

TABLE 3

DISTRIBUTION OF CASES AND DEATHS, AND MORBIDITY, MORTALITY AND CASE-FATALITY RATES BY AGE, AMONG CHILDREN 0-2 YEARS OF AGE IN THE URBAN (1-12) AND RURAL (13) WARDS FOR THE PERIOD 1 OCTOBER-3 DECEMBER 1965 IN SURAT

Wards	Age-group (months)	Estimated ^a population	No. of cases	No. of deaths	Proportionate case rate (%)	Morbidity rate per 100 population	Mortality rate per 10 000 population	Case-fatality rate (%)
1-12	0-5	6 789	16	1	4.3	0.2	1.5	6.3
	6-11	6 142	147	15	39.7	2.4	24.4	10.2
	12-23	12 168	187	12	50.6	1.5	9.9	6.4
	24-35	11 940	20	0	5.4	0.2	0.0	0.0
Total	0-35	37 039	370	28	100.0	1.0	7.6	7.6
13	0-5	463	1	0	5.6	0.2	0.0	0.0
	6-11	419	8	1	44.4	1.9	23.9	12.5
	12-23	830	9	3	50.0	1.1	36.1	33.3
	24-35	814	0	0	0.0	0.0	0.0	0.0
Total	0-35	2 526	18	4	100.0	0.7	15.8	22.2
Total for all wards		39 565	388	32	—	1.0	8.1	8.2

^a Estimated from annual births by the survival rates from 1961 Life Table, India, Western Zone, Registrar General, Government of India, Delhi.

wards 8-12 were low compared with the rest of the wards. This difference cannot be explained, as the city wards do not differ from each other socially, economically or in respect of overcrowding.

In an effort to assess the number of non-hospitalized cases, a survey was conducted in ward 4: the hospital in which gastroenteritis cases were admitted is situated in this ward. Of the 6255 families in the ward, 332 families were randomly selected for the survey. Out of 171 children in the 0-2-years age-group among the families surveyed, 17 cases of gastroenteritis occurred during November 1965. Of these, only 6 were treated at the hospital and 1 death was registered among those admitted. Three cases were reported in the 3-years-and-over age-group among the families surveyed. Projecting these rates to the total population, it was estimated that about 3500 cases might have occurred in Surat town during the period.

A comparison of gastroenteritis cases admitted to the hospital in October and November 1965, with those in the same months of 1963 and 1964 is given in Table 5. There were no other known cases

of gastroenteritis during these months in any of these years and no increase of bed strength of the hospital and hence the figures are comparable. The case-fatality rate was high during October in all 3 years. It may be assumed that only the serious cases were admitted to the hospital and that a large number of cases escaped hospitalization.

DISCUSSION

During the last 2 decades, numerous epidemics of acute gastroenteritis among infants and children due to enteropathogenic *E. coli* have been reported. Most of these epidemics occurred in closed communities like hospital wards and nurseries. Relatively few reports suggest that EEC gastroenteritis can be a community problem (Olarte et al., 1957; Taylor, 1960).

In a retrospective study, Kessner et al. (1962) calculated the community attack-rate from the infantile gastroenteritis cases admitted to 29 different hospitals. The data presented by them suggest that EEC gastroenteritis among infants was a significant

TABLE 4
MORBIDITY RATES, DEATH RATES AND CASE-FATALITY RATES AMONG HOSPITALIZED CASES
IN THE 0-2 YEARS AGE-GROUP BY TOWN WARDS FOR THE PERIOD 1 OCTOBER-3 DECEMBER 1965 IN SURAT

Ward no.	Total population ^a	Population 0-2 years of age ^b	No. of cases	Morbidity rate (%)	No. of deaths	Mortality rate per 10 000	Case-fatality rate (%)
1	25 061	3 220	42	1.3	3	9.3	7.1
2	33 448	4 299	45	1.0	2	4.6	4.4
3	40 302	5 179	57	1.1	6	11.6	10.5
4	39 599	5 088	76	1.5	9	17.7	11.8
5 & 6 ^c	36 070	4 634	52	1.1	5	10.8	9.6
7	39 542	5 079	40	0.8	2	3.9	5.0
8 & 9 ^c	28 539	3 667	23	0.6	1	2.7	4.3
10	12 930	1 662	9	0.5	0	0.0	0.0
11 & 12 ^c	32 766	4 211	26	0.6	0	0.0	0.0
Total—wards 1-12	288 257	37 039	370	1.0	28	7.0	7.6
Total—ward 13	23 616	2 526	18	0.7	4	15.0	22.2
Total—all wards	311 873	39 565	388	0.98	32	8.1	8.2

^a From 1961 census.

^b Estimated for 1965.

^c Wards having almost similar urban characteristics have been joined together.

community problem. A community epidemic of gastroenteritis caused by enteropathogenic *E. coli* O₁₂₆:B₁₆ was reported by Boris et al. (1964), who detected 39 cases during a 4-months period, in 3 geographically distinct areas. It would appear that these outbreaks did not create the state or

emergency that is generally associated with epidemics of certain communicable diseases.

During the outbreaks in Surat in 1965 a total of 534 cases of acute gastroenteritis was admitted to hospital and of this total 388 of the patients were under 3 years of age. The fact that the morbidity

TABLE 5
HOSPITALIZED CASES AND DEATHS DUE TO GASTROENTERITIS AMONG CHILDREN BELOW 3 YEARS OF AGE
IN OCTOBER AND NOVEMBER IN 1963, 1964 AND 1965

	1963		1964		1965	
	Oct.	Nov.	Oct.	Nov.	Oct.	Nov.
No. of cases	11	59	70	112	56	327
No. of deaths	2	3	14	13	7	25
Case-fatality rate	18.2	5.1	20.0	11.6	12.5	7.6
Cases of gastroenteritis in children under 3 years of age as a percentage of the total no. of cases	37.9	92.1	66.0	87.5	39.4	84.5
Cases of gastroenteritis in children under 3 years of age as a percentage of the total no. of hospital admissions	4.0	16.3	15.5	27.3	16.3	43.8

rate was highest in the 6–11-months age-group, and next highest in the 12–23-months age-group, may be a result of the common practice of replacing breast feeding by artificial feeding at the age of 6 months.

The hospitalized cases represent only part of the total illness in the community. A sample survey conducted in 1 of the wards revealed that the actual number of cases of EEC gastroenteritis in the community might have been many times greater. Among the families surveyed 10% of the children in the 0–2-years age-group had gastroenteritis.

The over-all mortality was 1.2 per 10 000 population while the mortality rate for the 0–2-years age-group was 8.1 per 10 000 children.

No marked difference in sex-specific morbidity and mortality in the total population was observed. However, the attack rate in the 0–2-years age-group was significantly higher among the boys than among the girls in the urban wards.

The exact mode of transmission of the disease during this epidemic could not be established. The

absence of an explosive outbreak, the equal involvement of the children in the urban and rural wards in spite of different sources of water supply, exclude water as the vehicle of spread. Similarly, the involvement of certain exclusively breast-fed infants, and absence of common source of milk supply to the affected families exclude the possibility of milk having any role in this respect. Individual scrutiny of the case records did not bring out any common food consumed by the affected children. Fly density was low during the period compared with the other months of the year.

Although no localized concentration of cases was observed it is possible that person-to-person transmission was responsible for the episode of gastroenteritis among the children in Surat. The factors that point towards this conclusion are that the epidemic built up slowly to a plateau without showing any abrupt explosive outbreak, the presence of *E. coli* O₈₆:B₇ carriers among mothers of some of the affected children, and the exclusion of other known modes of spread.

ACKNOWLEDGEMENTS

The authors are grateful to Dr R. G. Dandekar, Medical Officer of Health, Surat Municipality, Gujarat State, India, for his active co-operation in the present investigation. The authors are also thankful to Mr P.

Singha, Assistant Director, National Institute for Communicable Diseases, Delhi, for statistical analyses and to Mr Muni Lal Puri and Mr Ram Parsad for their technical help.

RÉSUMÉ

FORTE FLAMBÉE ÉPIDÉMIQUE DE GASTRO-ENTÉRITE À *ESCHERICHIA COLI* O₈₆: B₇, ENTÉROPATHOGENÈ DANS UNE COLLECTIVITÉ

Une importante épidémie de gastro-entérite aiguë s'est produite parmi les enfants de la ville de Surat, Etat de Gujerat (Inde), entre le 29 octobre et le 3 décembre 1965. Sur les 418 malades hospitalisés durant cette période, 344 avaient moins de 2 ans.

On a procédé à l'examen microbiologique d'échantillons de selles prélevés chez 81 enfants admis à l'hôpital entre le 25 et le 30 novembre et on a obtenu 34 cultures pures d'*Escherichia coli* O₈₆: B₇ et une d'*E. coli* O₁₂₆: B₁₆.

Pour l'ensemble de la population, on a enregistré un taux de morbidité de 0,16%; ce taux a atteint 0,98% dans le groupe d'âge 0-2 ans et le chiffre le plus élevé (2,4%) a été observé parmi les nourrissons de 6 à 11 mois dans les circonscriptions urbaines de Surat. Si l'on considère la totalité des habitants, la morbidité et la mortalité

n'ont pas accusé de différence marquée suivant le sexe. Cependant, dans les circonscriptions urbaines, le taux de morbidité pour le groupe d'âge 0-2 ans a été notablement plus élevé chez les garçons que chez les filles. Quant au taux de létalité, il a été de 8,2% dans le groupe d'âge 0-2 ans et de 5,5% parmi les enfants de 3 ans et plus.

L'épidémie a touché les 13 circonscriptions de la ville. Dans les 12 circonscriptions urbaines, le taux de morbidité a été de 1,0%, alors qu'il n'était que de 0,7% dans la circonscription rurale. Pour celle-ci, on a enregistré un taux de létalité de 22,2% contre 7,6% seulement dans les circonscriptions urbaines.

Pour évaluer le nombre des malades qui n'avaient pas été hospitalisés, on a mené une enquête par sondage qui

a montré que, dans 332 familles, sur 171 enfants âgés de 0 à 2 ans, 17 avaient été atteints de gastro-entérite, 6 d'entre eux étant hospitalisés et 11 soignés à domicile. Si l'on extrapole ces chiffres à l'ensemble de la popula-

tion, on peut estimer qu'il y a eu à Surat, à cette époque, environ 3500 cas de gastro-entérite aiguë. Il n'a pas été possible de déterminer le mode exact de transmission de la maladie.

REFERENCES

- Anderson, T., Crockatt, H. & Ross, C. A. C. (1954) *J. Path. Bact.*, **68**, 1
- Boris, M., Thomason, B. M., Hines, V. D., Montague, T. S. & Sellers, T. F., Jr (1964) *Pediatrics*, **33**, 18-29
- Cooper, M. L., Keller, H. M., Walters, E. W., Partin, J. C. & Boye, D. E. (1959) *Amer. J. Dis. Child.*, **97**, 235
- Giles, C. & Sangster, G. (1948) *J. Hyg. (Lond.)*, **46**, 1
- Harris, A. H., Yankauer, A., Green, D. C., Coleman, M. B. & Phaneuf, M. Y. (1956) *Ann. N. Y. Acad. Sci.*, **66**, 118
- Hinton, N. A. & MacGregor, R. R. (1958) *Canad. med. Ass. J.*, **79**, 359
- Kessner, D. M., Shaughnessy, H. J., Goodings, J. J., Rasmussen, C. M., Rose, N. J., Marshall, A. L., Jr Andalman, S. L., Hall, J. B. & Rosenbloom, P. J. (1962) *Amer. J. Hyg.*, **76**, 27-43
- Kirby, A. C., Hall, E. G. & Coackley, W. (1950) *Lancet*, **2**, 201
- Neter, E., Korns, R. F. & Trussell, R. (1953) *Pediatrics*, **12**, 377
- Olarte, J., Ramon-Alvarez, M. & Galindo, E. (1957) *Bol. méd. Hosp. infant. (Méx.)*, **14**, 263
- Rogers, K. B. (1951) *J. Hyg. (Lond.)*, **49**, 140
- Taylor, J. (1960) *Enteropathic Escherichia coli*. In: Dyke, S. C., ed., *Recent advances in clinical pathology*, Ser. 3, London, J. & A. Churchill Ltd., p. 78