Title: Quantitative changes in Bacterial Flora of the Gastrointestinal tract during Diarrheal Diseases

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The objective of this study is to quantitate the gastrointestinal bacterial flora of persons with and without diarrhea, and to determine differences, if any, between these two groups. Additional studies include the influence on intestinal flora of antimicrobial agents administered therapeutically to diarrhea patients or experimentally to non-diarrhea controls. Quantitative bacterial counts were obtained in 50 normal Thai adults before and after prolonged supplementary lactose in their diets. An investigation was also initiated to determine the incidence of antibiotic producing E. coli in the stools of children with and without clinical diarrhea.

Studies designed to quantitate the fecal bacterial flora were teminated last year, and similar studies utilizing intestinal juices were conducted during this reporting period.

Specimens were obtained by aspirating intestinal fluid through orally administered tubes. The total time lapse between collection of specimens and completion of processing was usually less than 1 hour for anaerobic incubation and less than 2 hours for aerobic incubation. Plate counts, on serial dilutions from 10^2 to 10^{10}, were carried out on the 9 media listed in Table XVI. In those instances when the same species of organism grew on more than one medium, the medium with the highest count was used. Routine bacteriological, biochemical, and serological procedures were used for final identification of organisms.

During the period of this report, duodeno-jejunal or jejunal fluid was obtained from 40 normal adult Thais, 20 normal children and 5 adults and 2 children with diarrhea. Ninteen of the 40 specimens from normal adults had at least 1 organism with counts greater than 10^3/ml. The most frequently encountered species were neisseria, coliforms, anaerobic streptococci, gram positive cocci, and pseudomonas. Four of the 5 intestinal fluids from adults with diarrhea had significant growth (more than 10^3 org/ml) of gram positive cocci, anaerobic streptococci or coliforms. Significant numbers of Pseudomonas spp. were also obtained from 2 samples. The total counts of most organisms from the upper gastrointestinal tract of both adults and children were from 10^2 to 10^6/ml of aspirated fluid.

Six of the 20 jejunal samples from normal children had at least 1 organism in concentrations greater than 10^3/ml. All 3 specimens (2 duodeno–jejunal and 1 jejunal fluid) obtained from 2 children with diarrhea showed significant numbers of E. coli. The range of total bacterial counts in aspirated fluid from the upper intestinal tract of patients with diarrhea were from 10^2 to 10^6, but bacterial counts were slightly higher than found in "normal" persons.

Tissue from 28 biopsys of the jejunum were compared with 20 fluid aspirates collected at the same time. Only 4 biopsy specimens (28%) had 10^3 orgs/gm of tissue, whereas 12 fluids (60%) showed 10^3 orgs/ml.

Four presumably normal infants were given kaomycin (neomycin plus kaolin) to determine the effect of this drug on their fecal flora. Unfortunately, all four children had to be dropped from the protocol for various reasons. One child developed multiple abscesses on the neck and she was given chloromycetin therapy. S. derby was isolated from the stool of another child who was dropped from the study, but did not develop clinical diarrhea. The remaining 2 children both became ill with diarrhea. E.E. coli, 0119:B11, and Sh. sonnei from 1 (10^5 orgs/gm of feces) were isolated from one child and S. anatum from the other. No additional drug studies were undertaken in children, however, quantitative studies on intestinal fluids from 7 normal adult Thais were studied before and after 4 grams of neomycin administered within a 24 hour period. Seventeen upper intestinal aspirates were obtained before administration of antibiotic and eleven after. A summary of the results is persented in Table XX. Eighteen intestinal fluid samples were obtained from 13 adult Thais after administration of tetracycline (5 subjects, 7 specimens), neomycin (5 subjects, 7 specimens), chloroquine (1 specimen), folic acid (1 specimen) and prednisone (1 subject, 2 specimens). No significant changes were noted either during or after the administration of each drug, with the exception of tetracycline when the organisms appeared to increase quantitatively in 2 of the 5 individuals.

Fifty normal Thai marines stationed at Sattahip were studied prior to and after the subjects were given 50 grams of lactose solution per day for one month. The objective of this study was to obtain baseline information on the bacterial flora of the small intestine in normal Thais, and the subsequent changes in fecal and intestinal flora after prolonged supplementary lactose in the diet. In conjunction with a lactose tolerance and intestinal biopsy study, upper small intestinal fluid was obtained by aspiration through a second tube which was inserted together with the Crosby–Kugler capsule. Stool specimens were collected at the beginning and termination of the experiment for quantitative bacterial studies. Due to limited field laboratory facilities and time limitations, it was impossible to do complete quantitative studies on the stool specimens. Therefore, only the numbers of lactobacilli were quantitatively examined. Forty two pre-lactose and 47 post-lactose stool specimens were studied. The mean difference in total lactobacilli before and after lactose administration indicates a slight increase in lactobacilli after one month of lactose. However. examination of the data is not complete, and the range of the total bacterial counts was so great ($10^5 - 10^9$), both pre and post lactose, that statistically significant differences in flora may be impossible to demonstrate.

The examination of intestinal fluid was conducted by preparing serial dilutions of the aspirated specimen and plating, by surface inoculation, onto the 9 media listed in Table XVI. The method was designed to detect organisms in concentrations as low as 100 per ml. Forty three controls (pre-lactose intestinal fluids) were quantitated. The results of the pre-lactose fluids were; no growth from 16% 10^2-10^3 organisms from 42% and an equal number (42%) with counts greater than 10^3/ml. The distribution of counts for the 48 post-lactose fluids were 21%, 48%, and 31%, respectively. The percentage recovery for each group of organisms is presented in Tables XVII, XVIII and XIX. The predominating organisms were streptococci (aerobic and anaerobic), enterococci and Neisseria spp. Other organisms were found only in lower numbers and less frequently. The significance of the large numbers of streptococci and Neisseria spp. in the upper intestinal fluid is questionable, since there are indications that these organisms may have been introduced into the specimens from higher in the gestrointestinal tract. Our previous experience with fluid obtained through the intestinal wall, at autopsy, did not reveal the presence of Neisseria spp. Similar studies described in the literature do not report the presence of Neisseria spp. when specimens were collected either during surgery or at autopsy. It was also noted in this study that when Neisseria spp. were found, the numbers of alpha streptococci also increased. For these reasons, it is entirely possible that at least some of the neisseriae and alpha streptococci were mechanically introduced, during the sampling procedure, from higher in the gastrointestinal tract. It should be noted from Table XVII that neither Clostridium nor Bacteroides spp. were recovered from any of the intestinal fluid specimens. The analysis of these data is not complete, however, the general impression is that the recovery percentages of coliform organisms was higher and the gram positive organisms lower after the administration of lactose.

A preliminary investigation was undertaken to determine the presence and prevalence of antibiotic producing E. coli in the stools of children with and without diarrhea. The initial phase consisted of a search

for a susceptible organism to serve as an indicator for the detection of antibiotic producing E. coli. Eighty strains of shigellae were checked for susceptibility to 29 antibiotic-producing E. coli, and the organisms selected as the indicator was a strain of Sh. sonnei form 1 which had been isolated from an American serviceman stationed in Thailand. Optimal conditions for conducting the assays were determined by studying the effects of quantitative changes in concentration of both the indicator shigellae strain and the E. coli inoculum, the effects of lapsed time between seeding the two organisms, and the influence of incubation time on the zone of inhibition. The following standard procedure was adopted. Samples of fecal material were obtained either by rectal swabs or stool specimens. They were streaked on MacConkey's and Salmonella–Shigella plates for isolation, and at least 10 colonies (5 from each medium) of suspected E. coli were transferred into Kligler's iron agar slants for further biochemical confirmation. E. coli strains were stocked for subsequent testing against the standard indicator Shigella strain. Enteropathogens isolated from diarrhea patients were also checked for susceptibility to strains of concomitantly occuring antagonistic E. coli. The assay for antibiotic producing E. coli was carried out in the following manner. Sixteen to 20 hour cultures of the susceptible strain of Sh. sonnei were diluted with sterile saline to approximately $10^5 - 10^6$ organisms per ml. The suspension was then flooded onto the surface of proteose # 3 agar plates, the excess drained, and the plates dried by incubation at 37°C for 30 minutes. Circular areas 7 to 10 mm. in diameter were inoculated with undiluted E. coli. permitting the assay of 8 strains on each plate. After 24 hours incubation, at 37°C, the zones of inhibition around the E. coli inoculum were measured and recorded as; 0 or inactive (no inhibition), + or slightly active (up to 2 mm inhibition), ++ or moderately active (greater than 2 mm inhibition).

The subjects for this study were all children under 2 years of age. Two groups were studied. Specimens from a non-diarrhea group were obtained from children in a private nursery, and specimens from children with diarrhea from patients admitted to the Royal Thai Army Hospital. A total of 1238 strains of E. coli were isolated from 111 specimens collected from 29 children. All were screened for inhibitory activity. In these limited data, the incidence of antibiotic-producing strains of E. coli was highest among the diarrhea patients with shigellae, or shigellae in combination with salmonellae. Patients with salmonellae, or salmonellae in combination with other pathogens, appeared to harbour fewer but more active antibiotic-producing E. coli (Table XXI). One asymptomatic child was found to be carrying both Salmonella newport and S. weltevreden. Thirty nine strains of E. coli from 3 specimens were assayed and 7 strains were found to be active. Five fo the 7 strains were highly antagonistic to the indicator strain, but none were active against the patient's own salmonellae. No active strains were detected after the patient was put on chloromycetin therapy nor during an episode of diarrhea of unknown etiology which developed after discontinuation of the drug.

Attempts were made to follow changes, if any, in the numbers of antibiotic-producing E. coli during the course of the diarrheal disease. These data are presented in Tables XXII and XXIII.

Eight shigellae isolates from patients with diarrhea were checked for susceptibility to their own strains of antibiotic producing E. coli. None of 3 strains of Sh. flexneri 3 were susceptible; however, 3 strains of Sh. sonnei form I, and a single isolate of Sh. dysenteriae 1 were inhibited by their own E. coli strains. Salmonellae strains were uniformily resistant to the inhibitory effects of E. coli, in contrast to the susceptibility of all Enteropathogenic E. coli isolated from children with diarrhea. An interesting observation was noted with isolates from a patient with diarrhea caused by Sh. boydii 6. The E. coli strains from this patient were not antagonistic when assayed with the standard Sh. sonnei indicator strain; however, they were inhibitory for the patient's pathogen, Sh. boydii 6. This finding combined with the low percentage of antibiotic producing E. coli found in this study, when compared with similar studies conducted in the U.S. (Tables XXIV and XXV), indicate a more sensitive indicator strain should be sought.

An investigation was initiated to determine the frequency with which various serotypes of Enteropathogenic E. coli produce antibiotics. Fifty three strains of E. E. coli. isolated from 53 children with

diarrhea, were assayed for activity using the standard Sh. sonnei strain. Only 3 strains showed a slight degree of activity. One hundred and four strains of antibiotic producing E. coli. isolated from all sources, were then checked for the presence of E. E. coli antigens, and all strains were found to be negative. These data indicate E. E. coli to be very poor antibiotic producers, but uniformly susceptible to the antibiotics produced by other E. coli.

Summary: Fluids aspirated from the upper gastrointestinal tract of children and adults, both "normal" and during diarrheal disease, contained significant numbers of bacteria (10^3 orgs/ml). The flora was predominantly gram positive cocci, fecal streptococci, lactobacilli and yeasts. The total counts of most organisms ranged from $10^2 - 10^6$ per ml of aspirated fluid. The bacterial counts were slightly higher in diarrhea patients. No significant numbers of bacteria were detected from intestinal biopsy tissue. The administration of neomycin sulfate, chloroquine, folic acid, or prednisone appear to have no influence on bacterial flora of intestinal fluids. In contrast, there was an increase in bacterial flora in 2 of 5 persons receiving experimentally administered tetracycline. The bacterial flora of 42% of the upper intestinal fluid samples, from normal Thai adults, contained at least 10^3 organisms per ml. After 50 grams of lactose solution per day for 30 days, the quantitative bacteriology of upper intestinal fluid was much the same as initial control specimens. Two groups of children, with and without diarrhea, were surveyed for the prevalence of antibiotic producing E. coli in their stools. 1238 strains of E. coli were screened for antibiotic production. The incidence of antagonistic E. coli was highest among patients from whom shigellae, or shigellae and salmonellae were both isolated. The lowest incidence was among diarrhea patients from whom salmonellae were recovered. Whenever possible the quantitative changes in antibiotic producing E. coli were followed throughout the course of the diarrhea. The incidence of antagonistic E. coli was lower in this study than previously found in the U.S. Only 3 of 53 Enteropathogenic E. coli strains exhibited inhibitory activity. Enteropathogens isolated from diarrhea patients varied in their susceptibility to the inhibitory activity of concomitantly occurring E. coli strains. E. E. coli were uniformly susceptible as were Sh. sonnei form I, Sh. boydii 6 and Sh. dysenteriae 1. All salmonellae and the 3 isolates of Sh. flexneri 3 were resistant.

General Information:

During the period covered by this report the following 5000 routine specimens were processed.

Water samples	1041
Urine specimens	231
Urethral specimens	247
Stool specimens	971
Dairy products	244
Throat swabs	197
Blood cultures	46
Sputum specimens	81
Pus & lesions	82
Cerebrospinal fluid	7
Miscellaneous cultures	155

Sera for

Heterophile Test	394
C-Reactive protein	29
Cold agglutinins	6
Febrile agglutinations	108
VDRL	1161

Table I

Enterobacteriaceae isolated from acute diarrhea cases in Thailand from 1 April 1966 through 31 March 1967

Month	No. of Specimens	Salmonellae	Shigellae	Paracolons
April 1966	255	68	17	31
May	276	95	3	77
June	376	61	26	83
July	274	15	9	65
August	221	17	13	133
September	274	47	12	79
October	161	30	12	49
November	238	27	12	95
December	176	32	13	25
January 1967	210	21	10	56
February	222	33	16	58
March	252	22	12	30
Total	2935	468	155	781
Percentage of Total Specimens		15.9	0.53	26.6

Table II

Salmonella species isolated in Thailand from 1 April 1966 through 31 March 1967

Species	Group	Children	Adults	Unknown	Total
Salmonella derby	B	82	4	3	89
S. paratyphi B	B	256	10	8	274
S. saint paul	B	2	0	0	2
S. stanley	B	3	1	0	4
S. typhimurium	B	2	0	0	2
S. heidelberg	B	1	0	0	1
S. montevideo	C_1	18	0	1	19
S. tennessee	C_1	2	0	0	2
S. virchow	C_1	1	0	0	1
S. oslo	C_1	3	0	0	3
S. typhisuis	C_1	2	0	0	2
S. bovismorbificans	C_2	5	0	0	5
S. newport	C_2	8	1	0	9
S. typhosa	D	10	2	0	12
S. anatum	E_1	17	1	0	18
S. lexington	E_1	6	0	0	6
S. meleagridis	E_1	1	0	0	1
S. weltevreden	E_1	18	0	0	18
Total		437	19	12	468
Percentage of isolations		93.4	4.0	2.6	

Table III

Shigella species isolated in Thailand from 1 April 1966 through 31 March 1967

Species	Group	Children	Adults	Unknown	Total
Shigella dysenteriae 1	A	11	1	0	12
Sh. dysenteriae 2	A	1	0	0	1
Sh. flexneri 1	B	4	0	0	4
Sh. flexneri 2	B	27	6	2	35
Sh. flexneri 3	B	48	9	6	63
Sh. flexneri 4	B	8	0	0	8
Sh. flexneri 6	B	3	0	0	3
Sh. boydii 2	C	1	0	0	1
Sh. boydii 4	C	1	0	0	1
Sh. sonnei form I	D	23	1	2	26
Sh. sonnei form II	D	1	0	0	1
Total		128	17	10	155
Percentage of isolations		82.6	11.0	6.4	

Table IV

Enteropathogenic Escherichia coli from Acute Diarrhea cases in Thailand from 1 April 1966 through 31 March 1967

	Thai nationals	Caucasians
Number examined	2062	169
Rough	1207	104
Negative	687	58
Positive	168	7
Serotypes		
025:B19:B23	52	2
026:B6	4	0
055:B5	1	0
086:B7	9	1
0112:B11	2	2
0119:B14	29	1
0125:B15	28	1
0126:B16	23	0
0127:B8	5	0
0128:B12	15	0

Table V

SENSITIVITY OF ENTERIC ORGANISMS TO TETRACYCLINE*
from 1 April 1966 through 31 March 1967

	No. of strains tested	Inhibited at mcg/ml									
		>200	200	100	50	25	12.5	6.25	3.12	1.56	0.78
S. paratyphi B	21	6	14	—	—	—	—	—	—	1	—
S. weltreveden	31	3	3	—	—	2	8	5	7	2	1
S. anatum	27	—	—	—	2	5	4	5	4	7	—
S. oslo	4	—	—	—	—	1	1	—	1	1	—
S. meleagridis	1	—	—	—	—	—	1	—	—	—	—
S. derby	11	—	—	—	—	—	—	3	2	6	—
S. bovismorbificans	3	—	1	1	—	—	1	—	—	—	—
S. montevideo	4	3	—	—	—	—	—	—	1	—	—
S. typhisuis	1	—	—	—	—	—	1	—	—	—	—
S. stanley	6	—	—	—	—	1	3	—	—	2	—
S. typhosa	14	—	—	—	—	—	6	4	2	2	—
S. lexington	9	1	—	—	—	—	5	1	—	2	—
S. manchester	2	—	—	—	—	—	2	—	—	—	—
S. newport	10	—	—	—	—	—	5	2	—	3	—
S. heidelberg	1	1	—	—	—	—	—	—	—	—	—
S. virchow	2	—	—	—	—	—	1	—	—	1	—
S. enteritidis	1	—	—	—	—	—	—	1	—	—	—
S. sain paul	3	2	—	—	—	—	—	—	1	—	—
S. thompson	1	—	—	—	—	—	—	—	—	1	—
S. paratyphi C	2	—	—	—	—	—	—	—	2	—	—
S. typhimurium	3	1	—	—	—	—	—	1	1	—	—
S. tennessee	2	—	—	—	—	—	1	—	—	—	1
Sh. sonnei form I	29	2	3	5	8	5	5	—	1	—	—
Sh. " " II	3	1	—	—	1	—	—	—	1	—	—
Sh. flexneri 1	6	3	2	—	—	1	—	—	—	—	—
Sh. " 2	33	1	2	7	11	1	6	5	—	—	—
Sh. " 3	40	—	30	2	2	4	2	1	—	—	—
Sh. " 4	13	4	2	1	—	—	1	—	—	—	—
Sh. " 6	4	—	—	1	1	1	—	—	—	1	—
Sh. dysenteriae 1	20	—	10	7	1	—	1	—	1	—	—
Sh. " 2	1	—	—	—	—	—	1	—	—	—	—
Sh. " 3	2	—	—	—	—	—	—	2	—	—	—
Sh. boydii 2	1	—	—	—	—	—	1	—	—	—	—
Sh. " 4	1	—	—	—	—	—	1	—	—	—	—
Sh. " 5	1	—	—	—	—	—	—	—	—	1	—
Sh. " 7	1	—	—	—	—	—	—	—	—	1	—
Pathogenic E. coli 055:B5	2	—	—	—	—	—	—	—	—	2	—
" 026:B6	3	1	1	—	—	1	—	—	—	—	—
" 086:B7	3	3	—	—	—	—	—	—	—	—	—
" 0112:B11	7	3	—	1	—	—	—	2	1	—	—
" 0128:B12	9	4	—	1	—	—	2	—	—	2	—
" 0119:B14	6	4	1	—	—	—	1	—	—	—	—
" 0125:B15	21	14	—	2	—	1	1	—	1	2	—
" 0126:B16	12	5	—	2	3	—	1	1	—	—	—
" 0124:B17	4	2	—	—	—	—	—	—	—	2	—
" 025:B19:B23	25	15	—	1	—	1	4	2	1	1	—

*Results are expressed as No. of isolates sensitive to each concentration

Table VI

SENSITIVITY OF ENTERIC ORGANISMS TO COLISTIN*
from 1 April 1966 through 31 March 1967

	No. of strain tested	Inhibited at mcg/ml									
		>200	200	100	50	25	12.5	6.25	3.12	1.56	0.78
S. paratyphi B	21	1	—	—	—	—	2	4	2	7	5
S. weltreveden	31	—	—	—	—	—	—	2	17	10	2
S. anatum	27	—	—	—	—	—	1	6	9	10	1
S. oslo	4	—	—	—	—	1	—	3	—	—	—
S. meleagridis	1	—	—	—	—	—	—	—	—	1	—
S. derby	2	—	—	—	—	—	—	2	3	4	2
S. bovismorbificans	3	—	—	—	—	—	1	2	—	—	—
S. montevideo	4	—	—	—	—	—	1	—	—	3	—
S. typhisuis	1	—	—	—	—	—	—	1	—	—	—
S. stanley	6	—	—	—	—	—	—	1	4	1	—
S. typhosa	14	—	—	—	—	—	—	—	1	3	10
S. lexington	9	—	—	—	—	—	—	2	3	2	2
S. manchester	2	—	—	—	—	—	—	2	—	—	—
S. newport	10	—	—	—	—	—	1	1	2	4	2
S. heidelberg	1	—	—	—	—	—	—	—	—	1	—
S. virchow	2	—	—	—	—	—	—	—	1	—	1
S. enteritidis	1	—	—	—	—	—	—	—	—	1	—
S. sain paul	3	—	—	—	—	—	—	—	2	1	—
S. thompson	1	—	—	—	—	—	—	—	—	1	—
S. paratyphi C	2	—	—	—	—	—	—	1	—	—	1
S. typhimurium	3	—	—	—	—	—	—	1	1	1	—
S. tennessee	2	—	—	—	—	—	—	1	—	1	—
Sh. sonnei form I	29	—	—	—	1	—	—	1	6	4	17
Sh. ,, ,, II	3	—	—	—	—	—	—	—	—	—	3
Sh. flexneri 1	6	—	—	—	—	—	—	1	1	1	4
Sh. ,, 2	32	—	—	—	3	1	3	—	1	4	20
Sh. ,, 3	39	—	—	1	—	—	—	2	1	8	27
Sh. ,, 4	13	—	—	—	—	—	—	—	1	4	8
Sh. ,, 6	5	—	—	—	—	—	—	—	1	2	2
Sh. dysenteriae 1	23	—	—	—	1	—	—	1	1	2	18
Sh. ,, 2	1	—	—	—	—	—	—	—	—	1	—
Sh. ,, 3	2	—	—	—	—	—	—	—	—	2	—
Sh. boydii 2	1	—	—	—	—	—	—	1	—	—	—
Sh. ,, 4	1	—	—	—	—	—	—	—	—	1	—
Sh. ,, 5	1	—	—	—	—	—	—	—	—	—	1
Sh. ,, 7	1	—	—	—	—	—	—	—	—	—	1
Pathogenic E. coli 055:B5	2	—	—	—	—	—	1	—	1	—	—
,, 026:B6	3	—	—	—	—	1	—	—	1	—	1
,, 086:B7	3	—	—	—	—	—	—	1	—	1	—
,, 0112:B11	7	—	—	—	—	—	1	2	2	—	2
,, 0128:B12	9	—	—	1	—	—	—	1	3	3	1
,, 0119:B14	6	—	—	—	—	—	—	1	—	2	3
,, 0125:B15	18	—	2	—	1	2	—	2	3	4	4
,, 0126:B16	12	—	2	—	—	—	—	—	2	4	4
,, 0124:B17	4	—	—	—	—	—	—	—	1	3	—
,, 025:B19:B23	25	—	1	—	—	—	—	2	9	2	11

* Results are expressed as No. of isolates sensitive to each concentration

Table VII

SENSITIVITY OF ENTERIC ORGANISMS TO KANAMYCIN SULFATE*

from 1 April 1966 through 31 March 1967

	No. of strains tested	Inhibited at mcg/ml									
		> 200	200	100	50	25	12.5	6.25	3.12	1.56	0.78
S. paratyphi B	—	—	—	—	—	—	—	—	—	—	—
S. Weltreveden	22	4	—	—	—	1	14	2	—	1	—
S. anatum	11	—	—	—	—	7	2	2	—	—	—
S. oslo	2	—	—	—	—	1	1	—	—	—	—
S. meleagridis	1	—	—	—	—	—	1	—	—	—	—
S. derby	—	—	—	—	—	—	—	—	—	—	—
S. bovismorbificans	3	—	—	—	—	1	2	—	—	—	—
S. montevideo	—	—	—	—	—	—	—	—	—	—	—
S. typhisuis	1	—	—	—	—	—	1	—	—	—	—
S. stanley	4	—	—	—	—	—	4	—	—	—	—
S. typhosa	8	—	—	—	—	—	—	7	1	—	—
S. lexington	6	—	—	—	—	1	4	1	—	—	—
S. manchester	2	—	—	—	—	2	—	—	—	—	—
S. newport	2	—	—	—	—	—	2	—	—	—	—
S. heidelberg	1	1	—	—	—	—	—	—	—	—	—
S. virchow	1	—	—	—	—	—	1	—	—	—	—
S. enteritidis	—	—	—	—	—	—	—	—	—	—	—
S. sain paul	1	1	—	—	—	—	—	—	—	—	—
S. thompson	—	—	—	—	—	—	—	—	—	—	—
S. paratyphi	—	—	—	—	—	—	—	—	—	—	—
S. typhimurium	1	1	—	—	—	—	—	—	—	—	—
S. tennessee	—	—	—	—	—	—	—	—	—	—	—
Sh. sonnei form I	12	—	—	—	—	—	10	2	—	—	—
Sh. " " II	1	—	—	—	—	—	1	—	—	—	—
Sh. flexneri 1	4	—	—	—	—	1	—	2	—	—	—
Sh. " 2	24	2	2	1	3	—	4	12	—	—	—
Sh. " 3	18	—	1	—	—	—	—	17	—	—	—
Sh. " 4	5	—	—	—	1	—	1	3	—	—	—
Sh. " 6	3	—	1	—	—	—	1	1	—	—	—
Sh. dysenteriae 1	16	—	—	—	2	—	1	9	4	—	—
Sh. " 2	1	—	—	—	—	1	—	—	—	—	—
Sh. " 3	2	—	—	—	—	—	—	2	—	—	—
Sh. boydii 2	1	—	—	—	—	1	—	—	—	—	—
Sh. " 4	1	—	—	—	—	—	—	1	—	—	—
Sh. " 5	—	—	—	—	—	—	—	—	—	—	—
Sh. " 7	—	—	—	—	—	—	—	—	—	—	—
Pathogenic E. Coli 055:B5	—	—	—	—	—	—	—	—	—	—	—
" 026:B6	—	—	—	—	—	—	—	—	—	—	—
" 086:B7	2	2	—	—	—	—	—	—	—	—	—
" 0112:B11	3	2	—	—	—	1	—	—	—	—	—
" 0128:B12	6	3	—	—	—	1	2	—	—	—	—
" 0119:B14	5	2	—	—	—	1	2	—	—	—	—
" 0125:B15	13	8	—	—	—	1	3	1	—	—	—
" 0126:B16	3	1	—	—	—	—	2	—	—	—	—
" 0124:B17	2	1	—	—	—	—	1	—	—	—	—
" 025:B19:B23	20	7	—	—	—	4	6	3	—	—	—

*Results are expressed as No. of isolates sensitive to each concentration

Table VIII

SENSITIVITY OF ENTERIC ORGANISMS TO CHLORAMPHENICOL*
from 1 April 1966 through 31 March 1967

	No. of strains tested	Inhibited at mcg/ml									
		>200	200	100	50	25	12.5	6.25	3.12	1.56	0.78
S. paratyphi B	21	11	1	—	—	—	—	—	4	5	—
S. Weltreveden	29	—	3	1	—	—	3	2	13	7	—
S. anatum	27	—	—	—	—	1	—	—	17	9	—
S. oslo	4	—	—	—	—	—	—	—	4	—	—
S. meleagridis	—	—	—	—	—	—	—	—	—	—	—
S. derby	11	—	—	—	—	—	—	2	1	8	—
S. bovismorbificans	3	—	2	—	—	—	—	—	1	—	—
S. montevideo	4	4	—	—	—	—	—	—	—	—	—
S. typhisuis	1	—	—	—	—	—	—	—	1	—	—
S. stanley	5	—	—	—	—	—	—	—	3	2	—
S. typhosa	12	—	—	—	—	—	—	—	2	10	—
S. lexington	9	—	—	—	—	—	—	1	3	5	—
S. manchester	2	—	—	—	—	—	—	2	—	—	—
S. newport	9	—	—	—	—	—	—	2	4	3	—
S. heidelberg	1	—	—	—	—	—	—	—	1	—	—
S. virchow	2	—	—	—	—	—	—	1	1	—	—
S. enteritidis	1	—	—	—	—	—	—	—	—	1	—
S. sain paul	3	—	1	—	—	—	—	1	1	—	—
S. thompson	1	—	—	—	—	—	—	—	1	—	—
S. paratyphi C	2	—	—	—	—	—	—	—	—	2	—
S. typhimurium	3	—	—	—	—	—	—	—	1	2	—
S. tennessee	2	—	—	—	—	—	—	—	—	2	—
Sh. sonnei form I	29	8	13	1	1	—	2	2	1	1	—
Sh. " " II	3	1	2	—	—	—	—	—	—	—	—
Sh. flexneri 1	6	1	2	1	2	—	—	—	—	—	—
Sh. " 2	32	1	2	10	11	1	—	—	5	3	—
Sh. " 3	29	1	2	16	15	4	—	—	—	1	—
Sh. " 4	13	1	—	7	4	1	—	—	—	—	—
Sh. " 6	5	—	—	1	—	—	1	—	—	3	—
Sh. dysenteriae 1	23	—	—	3	16	1	1	1	—	1	—
Sh. " 2	1	—	—	—	—	—	—	1	—	—	—
Sh. " 3	2	—	—	—	—	—	2	—	—	—	—
Sh. boydii 2	1	—	—	—	—	—	—	—	1	—	—
Sh. " 4	1	—	—	—	—	—	1	—	—	—	—
Sh. " 5	1	—	—	—	—	—	—	—	—	1	—
Sh. " 7	1	—	—	—	—	—	—	—	—	1	—
Pathogenic E. coli 055:B5	2	—	—	—	—	—	—	—	—	2	—
" 026:B6	3	—	—	1	1	—	—	—	—	1	—
" 086:B7	4	—	1	—	2	—	—	—	1	—	—
" 0112:B11	7	1	—	1	—	—	—	2	—	3	—
" 0128:B12	9	2	3	2	—	—	1	—	—	1	—
" 0119:B14	5	—	4	1	—	—	—	—	—	—	—
" 0125:B15	21	4	4	1	—	2	—	—	4	6	—
" 0126:B16	12	4	3	—	2	1	1	1	—	—	—
" 0124:B17	4	—	2	—	—	—	—	—	—	2	—
" 025:B19:B23	24	5	9	2	1	—	3	3	1	1	—

* Results are expressed as No. of isolates sensitive to each concentration

Table IX

SENSITIVITY OF ENTERIC ORGANISMS TO NEOMYCIN SULFATE*

from 1 April 1966 through 31 March 1967

	No. of strains tested	Inhibited at mcg/ml									
		>200	200	100	50	25	12.5	6.25	3.12	1.56	0.78
S. paratyphi B	21	20	—	—	—	—	1	—	—	—	—
S. weltreveden	31	5	—	—	—	—	12	11	3	—	—
S. anatum	27	—	—	—	2	1	15	6	1	—	—
S. oslo	4	—	—	—	—	2	—	1	1	—	—
S. meleagridis	1	—	—	—	—	—	1	—	—	—	—
S. derby	11	—	—	—	—	—	4	1	6	—	—
S. bovismorbificans	3	—	—	—	—	—	2	1	—	—	—
S. montevideo	4	3	1	—	—	—	—	—	—	—	—
S. typhisuis	1	—	—	—	—	—	1	—	—	—	—
S. stanley	6	—	—	—	—	—	2	4	—	—	—
S. typhosa	12	1	—	—	—	—	—	4	4	3	—
S. lexington	9	—	—	—	—	—	4	3	1	1	—
S. manchester	2	—	—	—	—	—	—	1	1	—	—
S. newport	9	—	—	2	—	—	3	4	—	—	—
S. heidelberg	1	1	—	—	—	—	—	—	—	—	—
S. virchow	2	—	—	—	—	—	2	—	—	—	—
S. enteritidis	1	—	—	—	—	—	—	—	1	—	—
S. sain paul	3	2	—	—	—	—	1	—	—	—	—
S. thompson	1	—	—	—	—	—	—	1	—	—	—
S. paratyphi C	2	—	—	—	—	—	1	—	—	1	—
S. typhimurium	3	1	—	—	—	—	—	2	—	—	—
S. tennessee	2	—	—	—	—	—	—	1	—	1	—
Sh. sonnei form I	28	—	—	—	—	—	2	19	2	5	—
Sh. " " II	3	—	—	—	—	—	2	—	1	—	—
Sh. flexneri 1	6	—	—	—	—	—	—	4	2	—	—
Sh. " 2	33	—	—	—	1	—	—	22	10	—	—
Sh. " 3	40	—	—	—	—	—	—	13	20	7	—
Sh. " 4	13	—	—	—	—	—	—	6	6	1	—
Sh. " 6	5	—	—	—	—	—	1	2	2	—	—
Sh. dysenteriae 1	23	—	—	—	—	1	—	1	16	5	—
Sh. " 2	1	—	—	—	—	—	1	—	—	—	—
Sh. " 3	2	—	—	—	—	—	—	2	—	—	—
Sh. boydii 2	1	—	—	—	—	—	1	—	—	—	—
Sh. " 4	1	—	—	—	—	—	—	—	1	—	—
Sh. " 5	1	—	—	—	—	—	—	1	—	—	—
Sh. " 7	1	—	—	—	—	—	—	—	1	—	—
Pathogenic E. coli 055:BS	2	1	—	—	—	—	1	—	—	—	—
" 026:B6	3	1	—	—	—	—	1	1	—	—	—
" 086:B7	3	2	—	—	—	—	—	1	—	—	—
" 0112:B11	6	—	—	1	—	1	3	1	—	—	—
" 0128:B12	10	3	1	—	—	—	6	—	—	—	—
" 0119:B14	6	3	—	—	—	—	3	—	—	—	—
" 0125:B15	21	10	—	1	—	—	6	3	—	1	—
" 0126:B16	12	10	—	—	—	—	2	—	—	—	—
" 0124:B17	4	1	—	—	—	—	3	—	—	—	—
" 025:B19:B23	25	8	—	—	—	—	7	8	2	—	—

* Results are expressed as No. of isolates sensitive to each concentration

Table X

SENSITIVITY OF ENTERIC ORGANISMS TO NALIDIXIC ACID*
from 1 April 1966 through 31 March 1967

		No. of strain tested	Inhibited at mcg/ml									
			> 200	200	100	50	25	12.5	6.25	3.12	1.56	0.78
S. paratyphi B		21	—	—	—	—	—	—	2	5	3	11
S. anatum		16	—	—	—	—	—	—	3	4	2	7
S. newport		7	—	—	—	—	—	—	—	—	3	4
S. weltreveden		9	—	—	—	—	—	—	1	1	3	4
S. derby		11	—	—	—	—	—	—	—	2	1	8
S. stanley		2	—	—	—	—	—	—	—	—	—	2
S. montevideo		4	—	—	—	—	—	—	2	2	—	—
S. lexington		3	—	—	—	—	—	—	—	—	3	—
Sh. sonnei form I		17	—	—	—	—	—	—	—	1	6	10
Sh. ,, ,, II		2	—	—	—	—	—	—	—	1	1	—
Sh. flexneri 1		2	—	—	—	—	—	—	—	—	—	2
Sh. ,, 2		9	—	—	—	—	—	—	—	2	3	4
Sh. ,, 3		22	—	—	—	—	—	—	—	6	3	13
Sh. ,, 4		8	—	—	—	—	—	—	—	1	2	5
Sh. ,, 6		2	—	—	—	—	—	—	—	—	—	2
Sh. boydii 5		1	—	—	—	—	—	—	—	—	1	—
Sh. ,, 7		1	—	—	—	—	—	1	—	—	—	—
Sh. dysenteriae 1		9	—	—	—	—	—	—	—	—	2	7
Pathogenic E. coli	055:B5	2	—	—	—	—	—	1	1	—	—	—
,,	026:B6	3	—	—	—	—	—	—	2	—	—	1
,,	086:B7	1	—	—	—	—	—	—	—	—	1	—
,,	0112:B11	5	—	—	—	—	—	—	—	2	1	2
,,	028:B12	4	—	—	—	—	—	—	—	—	—	4
,,	0119:B14	1	—	—	—	—	—	—	—	—	—	1
,,	0126:B16	9	—	—	—	—	—	—	—	—	4	5
,,	0124:B17	2	—	—	—	—	—	—	1	1	—	—
,,	025:B19:B23	4	—	—	—	—	—	—	1	1	—	2

*Results are expressed as No. of isolates sensitive to each concentration

Table XI

Survey of Enteric Pathogens at Central Preventorium for Children
Nondhburi Province, Thailand July 1966

Total subject 227 — Adults 75
— Children 152*

Total stool specimens 247
Specimens from Fomites 21

Source of Specimens	Total specimens	Pathogenic E. coli	Salmonella	Shigella
Children without Diarrhea	136	22 (16.2%)	10 (7.4%)	1 (.07%)
Children with Diarrhea	36	9 (25%)	6 (16.7%)	0
Adults without Diarrhea	73	8 (11.0%)	10 (13.7%)	3 (4.1%)
Adults with Diarrhea	2	0	1 (50%)	0
Fomites	21	2	0	0

* 20 subjects had 2 cultures examined.

Table XII
Survey of Enteric Pathogens at Central Preventorium for Children
Nondhburi Province, Thailand, July 1966

Source of specimens	Ward	Total Specimens	Pathogenic E. coli		Salmonella		Shigella	
			Group	No.	species	No.	species	No.
Children without Diarrhea	A	51	C 0125:B15	2	anatum	1	flexneri 2	1
			C 0128:B12	1	lexington	2		
			C 025:B19:B23	6	derby	1		
					montevideo	1		
	B	85	C 0125:B15	1	anatum	1		
			C 025:B19:B23	12	lexington	1		
					montevideo	3		
Children with	A	10	C 025:B19:B23	1	lexington	1		
					newport	1		
					weltevreden	1		
	B	26	C 0125:B15	3	weltevreden	1		
			C 025:B19:B23	5	montevideo	2		
Adults without Diarrhea	A	34	B 0124:B17	2			flexneri 2	1
			C 0125:B12	2	anatum	2	dysenteriae 1	1
			C 025:B19:B23	2	lexington	1		
					derby	2		
					typhimurium	1		
	B	39	B 086:B7	1	typhimurium	1	boydii	1
			C 025:B19:B23	1	derby	1		
					lexington	1		
					weltevreden	1		
Adults with Diarrhea	A	0	—		—			
	B	2	—		oslo	1		
Fomites	A	10	C 025:B19:B23	1				
	B	11	C 025:B19:B23	1				

Table XIII

Survey of Enteric Bacterial Pathogens in Nakornpanom, Thailand
(May 1966)

Source of specimens	Total	Path. E. Coli	Shigellae	Salmonellae
Thai adults without diarrhea	56	2	0	0
Thai adults with diarrhea	24	0	3	2
Thai children without diarrhea	38	1	0	2
Thai Children with diarrhea	11	1	4	1

Table XIV

Survey of Intestinal Parasites in Nakornpanom, Thailand (16 May—19 May 1966)

Sources of Specimens	No. of Specimens examined	No. of Positive Specimens	Helminths					Protozoa			No parasites seen
			Nematoda				Trematoda	Intestinal			
			Ascaris Lembricoides	Trichuris Trichina	Hookworm	Strongeloides stercoralis	Opistorchis	Entamoeba coli	Entamoeba histolytica	Chilomastri-semesnili	
Normal Thai adults A	45	24	1	2	3	2	13	5	2	—	21
Thai adults with diarrhea G	9	4	—	—	—	—	—	3	1	—	5
Normal Thai children F	33	12	1	1	2	0	5	4	—	1	21
Thai children with diarrhea E	9	2	—	—	—	—	—	2	—	—	7

Table XV

Enteropathogens recovered from Praputhabath hospital patients using Sander's methodology

Total Specimens	Adults	Children	Salmonellae	Shigellae	Enteropathogenic E. Coli
141	34	107	13	13	14

Distribution of species

Salmonellae

S. typhimurium	7
S. saint paul	6

Shigellae

Sh. dysenteriae 1	1
Sh. flexneri 1	2
Sh. flexneri 3	7
Sh. flexneri 4	1
Sh. sonnei form II	1
Alkalescens-dispar 04	1

E. E. coli

025:B19:B23	2
026:B6	1
055:B5	1
086:B7	1
0119:B14	2
0124:B17	1
0125:B15	2
0128:B12	4

Table XVI

Culture Media Used for Enumeration of Intestinal Aspirates

Medium	Specific for	Incubation condition (37°C)	
		Time (Hrs)	Environment
Blood Agar	Total aerobes	24	aerobib
MacConkey Agar	Total gram negative aerobes	24	aerobic
Mannitol Salt Agar	Staphylococci	24	aerobic
SF Agar	Fecal Streptocci	96	aerobic
Tellurite*	vibrio	24	aerobic
Sabouraud Dextrose Agar	Yeast	24	aerobic
Blood Agar	Total Anaerobes	48	anaerobic
Neomycin Blood Agar	Total gram neg. anaerobes	48	anaerobic
Lactobacillus	Lactobacilli	48	anaerobic

*Alkaline lauryl sulfate tellurite

Table XVII

Bacterial Growth from Upper Intestinal Aspirates in Normal Thai Adults during Lactose Tolerance Study

Bacteria	Percentage Recovery Pre-lactose		Percentage Recovery Post-lactose	
	10^2-10^7	$>10^3$	10^2-10^7	$>10^3$
Coliform	11.63	4.65	14.58	8.33
Staphylococci	32.56	4.65	22.92	0
Streptococci	44.19	32.56	31.25	25.00
Enterococci	23.26	2.33	18.75	4.17
Diphtheroids, Bacillus	34.88	2.33	35.42	8.33
Proteus, Pseudomonas	6.98	0	2.08	2.09
Veillonella	4.65	0	10.41	2.09
Neisseria	18.61	18.60	18.75	8.33
Clostridia	0	0	0	0
Bacteroides	0	0	0	0
Lactobacilli	2.33	0	2.08	0
Yeast	30.23	2.33	33.33	2.09

Table XVIII

Comparison of Quantitative Bacterial Flora of Intestinal Aspirates

Bacteria	Period of study	Total specimens	Range	Median
Coliform	Pre-lactose Post-lactose	43 48	$<10^2$ to 10^4 $<10^2$ to 10^5	$<10^2$ $<10^2$
Proteus sp., Pseudomonas sp.,	Pre-lactose Post-lactose	43 48	$<10^2$ to 10^2 $<10^2$ to 10^4	$<10^2$ $<10^2$
Lactobacilli	Pre-lactose Post-lactose	43 48	$<10^2$ to 10^3 $<10^2$ to 10^2	$<10^2$ $<10^2$
Diphtheroids, Bacillus sp.	Pre-lactose Post-lactose	43 48	$<10^2$ to 10^4 $<10^2$ to 10^4	$<10^2$ $<10^2$
Veillonella sp.	Pre-lactose Post-lactose	43 48	$<10^2$ to 10^3 $<10^2$ to 10^4	$<10^2$ $<10^2$
Neisseria sp.	Pre-lactose Post-lactose	43 48	$<10^2$ to 10^6 $<10^2$ to 10^6	$<10^2$ $<10^2$
Streptococci	Pre-lactose Post-lactose	43 48	$<10^2$ to 10^6 $<10^2$ to 10^7	$<10^2$ $<10^2$
Enterococci	Pre-lactose Post-lactose	43 48	$<10^2$ to 10^4 $<10^2$ to 10^5	$<10^2$ $<10^2$
Staphylococci	Pre-lactose Post-lactose	43 48	$<10^2$ to 10^5 $<10^2$ to 10^2	$<10^2$ $<10^2$
Yeast	Pre-lactose Post-lactose	43 48	$<10^2$ to 10^4 $<10^2$ to 10^4	$<10^2$ $<10^2$

Table XIX

Comparison of Frequency Distribution of Bacterial Counts of Intestinal Aspirates

Bacteria		Bacterial counts/ml of Intestinal Fluid						
		$<10^2$	10^2	10^3	10^4	10^5	10^6	10^7
Coliform	Pre	38	1	2	2	0	0	0
	Post	41	0	3	3	1	0	0
Proteus, Pseudomonas	Pre	40	3	0	0	0	0	0
	Post	47	0	0	1	0	0	0
Lactobacilli	Pre	42	0	1	0	0	0	0
	Post	47	1	0	0	0	0	0
Diphtheroids, Bacillus	Pre	28	12	2	1	0	0	0
	Post	31	10	3	3	1	0	0
Veillonella	Pre	41	1	1	0	0	0	0
	Post	43	2	2	1	0	0	0
Neisseria	Pre	35	0	0	3	3	2	0
	Post	39	1	5	1	2	0	0
Streptococci	Pre	24	1	4	4	5	5	0
	Post	33	0	3	7	1	3	1
Enterococci	Pre	32	4	6	1	0	0	0
	Post	39	5	2	1	1	0	0
Staphylococci	Pre	29	8	4	1	1	0	0
	Post	37	11	0	0	0	0	0
Yeast	Pre	30	7	5	1	0	0	0
	Post	32	14	1	1	0	0	0

Table XX

The effects of Neomycin* on bacterial flora of normal upper G-I tract

No. of subjects	No. of specimens		# specimens with significant growth		Organisms detected	
	Pre Rx	Post Rx	Pre Rx	Post Rx	Pre Rx	Post Rx
7	17	11	2***	0	Streptococcus	Streptococcus
					Staphylococcus	Staphylococcus
					Diphtheroids	Diphtheroids
					Yeast	Yeast
					Bacillus sp.	Proteus sp.
					Lactobacilli	Coliform
					Pseudomonas	Pseudomonas

* Total of 4 grams in 24 hours

** More than 10^3 count/ml

*** Significant growth of streptococci

Table XXI

Summary of Antibiotic producing E. coli isolated from children under 2 years of age*

Group	No. of individuals	No. of specimens	No. of E. coli strains	Distribution of E. coli strains**						antagonists/ E. coli tested		Specimens c antagonists/ Total specimens	
				0	(%)	+	(%)	++	(%)				
A Normal subjects	9	28	260	241	92.70	18	6.92	1	0.38	19/260	7.30%	6/28	21.43%
Clinically ill, B positive salmonella	3	13	122	121	99.28	0	0	1	0.82	1/122	0.82%	1/13	7.69%
Clinically ill, C salmonella and Path. E. coli	5	17	154	149	96.73	1	0.65	4	2.54	5/154	3.24%	4/17	23.53%
Clinically ill, D shigella positive	7	30	234	189	80.77	36	15.39	9	3.84	45/234	19.23%	10/30	33.33%
Clinically ill, E shigella and salmonella	5	23	192	142	73.59	3	1.56	47	24.85	50/192	26.41%	9/23	39.12%

0 = Inactive
\+ = Slightly active
++= Moderately active

* Specimens from Salmonellae carriers and diarrhea of unknown etiology are not included.
** as tested with standard Sh. sonnei form I indicator strain.

Table XXII

Follow up cultures from clinically ill patients from whom both Shigellae and Salmonellae were isolated

Subject (organisms isolated)	Date of onset	Culture Date	#E. coli strains*			Total E.coli strains			Total antagonists Total No. E. coli
			0	+	++	0	+	++	
PD 11 (Sh. flexneri 3, S. paratyphi B)	15 Feb 67	21 Feb 67	0	0	10	9	0	31	77.50%
		22 Feb 67	0	0	10				
		23 Feb 67	0	0	10				
		1 Mar 67	9	0	1				
PD 12 (Sh. flexneri 3, S. paratyphi B)	Unknown	21 Feb 67	10	0	0	22	0	5	18.52%
		22 Feb 67	2	0	5				
		23 Feb 67	10	0	0				
PD 4 (Sh. flexneri 1, S. paratyphi B)	21 Jan 67	25 Jan 67	10	0	0	42	0	8	16.00%
		26 Jan 67	10	0	0				
		27 Jan 67	11	0	0				
		30 Jan 67	1	0	4				
		3 Feb 67	4	0	0				
		7 Feb 67	6	0	4				
PD 14 (Sh. boydii 4, S. paratyphi B, E. E. coli-B:086:B7)	25 Feb 67	28 Feb 67	6	0	2	44	0	3	6.38%
		1 Mar 67	9	0	1				
		2 Mar 67	12	0	0				
		6 Mar 67	10	0	0				
		8 Mar 67	3	0	0				
		17 Mar 67	4	0	0				
PD 19 (Sh. flexneri 3, S. paratyphi B)	1 Mar 67	7 Mar 67	10	0	0	25	3	0	10.71%
		8 Mar 67	2	3	0				
		9 Mar 67	3	0	0				
		14 Mar 67	10	0	0				

Ave. 20.7%

0 = Inactive
+ = Slightly active
++ = Moderately

* as tested with standard Sh. sonnei form I indicator strain.

Table XXIII

Follow up cultures of clinically ill patients from whom Shigellae were isolated

Subject (organisms isolated)	Date of onset	Culture Date	# E. coli strains*			Total E. coli strains			Total antagonists Total No. E. coli
			0	+	++	0	+	++	
PN 6 (Sh. sonnei form I)	27 Feb 67	27 Feb 67	3	0	0	10	3	0	23.08%
		28 Feb 67	2	0	0				
		2 Mar 67	5	3	0				
PN 5 (Sh. sonnei form I)	2 Mar 67	8 Mar 67	6	0	0	26	0	0	0%
		9 Mar 67	10	0	0				
		13 Mar 67	10	0	0				
PD 6 (Sh. boydii 6)	1 Jan 67	27 Jan 67	0	10	0	31	12	1	29.54%
		1 Feb 67	9	0	0				
		7 Feb 67	5	0	0				
		13 Feb 67	9	0	1				
		21 Feb 67	8	2	0				
PD 7 (Sh. flexneri 3)	26 Jan 67	3 Feb 67	10	0	0	34	1	0	2.85%
		6 Feb 67	10	0	0				
		8 Feb 67	2	1	0				
		9 Feb 67	2	0	0				
		17 Feb 67	10	0	0				
PD 8 (Sh. flexneri 3)	5 Feb 67	6 Feb 67	10	0	0	22	0	0	0%
		8 Feb 67	10	0	0				
		9 Feb 67	2	0	0				
PD 9 (Sh. dysenteriae 1)	Unknown	9 Feb 67	4	0	0	23	20	1	47.72%
		10 Feb 67	10	0	0				
		14 Feb 67	9	0	1				
		16 Feb 67	0	10	0				
		21 Feb 67	0	10	0				
PD 10 (Sh. sonnei form I)	18 Feb 67	22 Feb 67	10	0	0	42	0	7	14.29%
		23 Feb 67	4	0	0				
		28 Feb 67	6	0	0				
		2 Mar 67	7	0	3				
		6 Mar 67	8	0	0				
		8 Mar 67	7	0	4				

Ave. 19.3%

0 = Inactive
+ = Slightly active
++ = Moderately

* as tested with standard Sh. sonnei form I indicator strain.

Table XXIV

Comparison of Incidence of Antagonistic E. coli among non-diarrhea subjects in North America and Bangkok

Group	Age	Total strains E. coli	Coliform strains							
			0	%	+	%	++	%	+&++	%
N. Y. State[1]	5-22 yrs	2648	2339	88.30	192	7.30	117	4.40	309	11.70
North Carolina State[2]	Adults	2105	1583	75.20	408	19.40	114	5.40	522	24.80
South Texas[3]	Under 10 yrs	1243	1015	81.70	104	8.3	124	10.00	228	18.30
Bangkok	Under 2 yrs	260	241	92.8	18	6.74	1	0.46	19	7.20

1 Halbert, S. P. 1948. The relation of antagonistic coliform organisms to shigella infections. J. Immunol. 60:(1), 1948.

2. Halbert, S. P., and M. Gravatt. Prevalence of antibiotic - producing coliform organisms. Public Health Reports, 64:(10), 313-318, 1949.

3. Halbert, S. P. The antagonism of coliform bacteria against shigellae. J. Immunol. 58: 1948.

Table XXV

Comparison of Incidence of Antagonistic E. Coli among Patients with shigellosis in New York State and Bangkok

Group	Age	Total strains coliform	Coliform strains							
			0	%	+	%	++	%	+&++	%
N.Y. State[1]	5-22 yrs	1578	1012	64.10	383	24.27	183	11.63	566	35.90
Bangkok	Under 2 yrs	234	189	80.70	36	15.39	9	3.84	45	19.23

1 Halbert, S.P. The relation of antagonistic coliform organisms to shigella infections. J. Immunol. 60: (3), 1948.